GIBBSSAR Amendment 9

Instruction Sheet

The following instructional information is being provided to insert Amendment 9 into GIBBSSAR, the Gibbs & Hill standard safety analysis report. Please destroy the sheets removed and insert the new sheets as indicated below.

Remove the effective page listing from the front of each volume and the question status table from the front of volume 6 and insert the new effective page listing and question status table. Remove and insert other pages as indicated below:

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Remove (Front/Back)	Insert (Front/Back)
T3.2-1 Sh 6/T3,2-1 Sh 7	T3,2-1 Sh 6/T3.2-1 Sh 7
T3.2-1 Sh 8/-	T3.2-1 Sh 8/-
T3.2-1 Sh 9/T3.2-1 Sh 10	T3.2-1 Sh 9/T3.2-1 Sh 10
3.6-1/3.6-2	3.6-1/3.6-2
3.6-5b/3.6-6	3.6-5b/3.6-6
T3.6-1 Sh 1/T3.6-1 Sh 2	T3.6-1 Sh 1/T3.6-1 Sh 2
3.10-1/3.10-2	3.10-1/3.10-1a
	3.10-2/-
T6.1-6/-	T6.1-6/-
6.2-23/6.2-24	6.2-23/6.2-24
6.2-25-6.2-25a	6.2-25-6.2-25a
6.2-26/6.2-27	6.2-26/6.2/27
6.2-28/6.2-29	6.2-28/6.2-29
6.2-29a/6.2-29b	6.2-29a/6.2-29b
6.2-29c/6.2-30	6.2-29c/6.2-30
6.2-47/6.2-47a	6.2-47/6.2-47a
6.2-48/6.2-49	6.2-48/6.2-49
T6.2-18 Sh 1/T6.2-18 Sh 2	T6.2-18 Sh 1/T6.2-18 Sh 2
T6.2-18 Sh 2a/-	
T6.2-18 Sh 3/-	T6.2-18 Sh 3/-
6.5-3/6.5-4	6.5-3/6.5-4
6.5-5/6.5-6	6.5-5/6.5-5a
6.5-7/6.5-8	6.5-6/6.5-7
	6.5-7a/6.5-8
6.5-9/6.5-10	6.5-9/6.5-10
	6.5-10a/-
6.5-17/6.5-18	6.5-17/6.5-18
6.5-19/6.5-19a	6.5-19/6.5-19a
T6.5-3/-	T6.5-3/T6.5-4 Sh 1
T6.5-4 Sh 1/T6.5-4 Sh 2	T6.5-4 Sh 2/T6.5-5
T6.5-5/T6.5-6	T6.5-6/T6.5-7
T6.5-7/-	
7-iii/-	7-iii/7-iv
	7-iva/7-ivb
	7-ivc/-
7.1-3/7.1-4	7.1-3/7.1-4
7.1-5/7.1-6	7.1-5/7.1-6
7.3-3/7.3-3a	7.3-3/7.3-3a
7.3-4/7.3-4a	7.3-4/7.3-4a
7.3-9/7.3-10	7.3-9/7.3-10
7.3-17/7.3-18	7.3-17/7.3-18
9.2-1/9.2-1a	9.2-1/9.2-1a
9.2-2/-	9.2-2/9.2-3
9.2-3/9.2-4	9.2-4/9.2-5
9.2-5/9.2-6	9.2-6/9.2-7
9.2-7/9.2-8	9.2-8/9.2-8a
9.2-9/9.2-10	9.2-9/-

Remove (Front/Back)	Insert (Front/Back)
9.2-11/9.2-12	9.2-10/9.2-11
9.2-11/9.2-12	9.2-12/9.2-12a
9.2-12a/9.2-13	9.2-13/9.2-13a
9.2-13a/9.2-14	9.2-14/9.2-15
9.2-15/9.2-16	9.2-16/9.2-17
9.2-17/9.2-18	9.2-18/9.2-18a
	9.2-19/-
9.2-19/9.2-20	9.2-20/9.2-20a
9.2-21/9.2-22	9.2-21/9.2-22
9.2-23/9.2-24	9.2-23/9.2-24
9.2-25/9.2-26	9.2-25/9.2-26
9.2-26a/9.2-27	9.2-26a/9.2-27
T9.2-1 Sh 1/T9.2-1 Sh 2	T9.2-1 Sh 1/T9.2-1 Sh 2
T9.2-3/T9.2-4	T9.2-3/T9.2-4
T9.2-6 Sh 1/T9.2-6 Sh 2	T9.2-6 Sh 1/T9.2-6 Sh 2
T9.2-6 Sh 3/T9.2-6 Sh 4	T9.2-6 Sh 3/T9.2-6 Sh 4
T9.2-6 Sh 5/T9.2-6 Sh 6	T9.2-6 Sh 5/T9.2-6 Sh 6
T9.2-7 Sh 1/T9.2-7 Sh 2	T9.2-6 Sh 6a/T9.2-7 Sh 1
T9.2-7 Sh 3/T9.2-7 Sh 4	T9.2-7 Sh 2/T9.2-7 Sh 3
T9.2-7 Sh 5/T9.2-7 Sh 6	T9.2-7 Sh 4/T9.2-7 Sh 5
	T9.2-7 Sh 6/T9.2-7 Sh 7
T9.2-8 Sh 1/T9.2-8 Sh 2	T9.2-8 Sh 1/T9.2-8 Sh 2
T9.2-8 Sh 3/-	T9.2-8 Sh 3/-
9.5-23L/9.5-24	9.5-23L/9.5-24
9.5-25/9.5-26	9.5-24a/9.5-25
	9.5-25a/9.5-25b
	9.5-25c/9.5-25d
9.5-27/9.5-28	9.5-26/9.5-27
	9.5-27a/9.5-28
9.5-31/9.5-32	9.5-31/9.5-32
9.5-32a/-	9.5-32a/-
	T10.3-21/-
10.4-28/10.4-28a	10.4-28/10.4-28a
T10.4-4 Sh 1/T10.4-4 Sh 2	T10.4-4 Sh 1/T10.4-4 Sh 2
11.4-1/11.4-1a	11.4-1/11.4-1a
11.4-2/11.4-2a	11.4-2/11.4-3
11.4-3/11.4-4	11.4-4/11.4-5
11.4-4a/11.4-5	
11.4-6/-	11.4-6/11.4-7
11.4-7/11.4-8	11.4-8/11.4-9
11.4-9/11.4-10	11.4-10/11.4-10a
11.4-10a/11.4-11	11.4-11/11.4-12
11.4-12/-	
T11.4-5 Sh 1/T11.4-5 Sh 2	T11.4-5 Sh 1/T11.4-5 Sh 2
T11.4-5 Sh 3/T11.4-5 Sh 4	T11.4-5 Sh 3/T11.4-5 Sh 4
T11.4-5 Sh 7/T11.4-5 Sh 8	T11.4-5 Sh 7/T11.4-5 Sh 8
T11.4-5 Sh 9/T11.4-5 Sh 10	T11.4-5 Sh 9/T11.4-5 Sh 10
11.5-3/11.5-4	11.5-3/11.5-3a

Remove (Front/Back)	Insert (Front/Back)
11.5-5/11.5-6	11.5-4/11.5-5
	11.5-5a/11.5-6
12.3-17/12.3-18	12.3-17/12.3-18
	12.3-18a/-
	Q111-61/Q111-62
	Q122-8/Q122-9
	Q122-10/Q122-11
	Q122-121/-

<u>Figures</u>

Remove	Insert
6.2-25	6.2-25
7.3-1 Sh. 1	7.3-1 Sh. A
7.3-1 Sh. 2	7.3-1 Sh. B
7.3-1 Sh. 3	7.3-1 Sh. C
7.3-1 Sh. 4	7.3-1 Sh. D
7.3-1 Sh. 5	7.3-1 Sh. 1
7.3-1 Sh. 6	7.3-1 Sh. 1A
7.3-1 Sh. 7	7.3-1 Sh. 1B
7.3-1 Sh. 8	7.3-1 Sh. 1C
7.3-1 Sh. 9	7.3-1 Sh. 1D
7.3-1 Sh. 10	7.3-1 Sh. 2
	7.3-1 Sh. 2A
	7.3-1 Sh. 2B
	7.3-1 Sh. 2C
	7.3-1 Sh. 2D
	7.3-1 Sh. 2E
	7.3-1 Sh. 2F
	7.3-1 Sh. 2G
	7.3-1 Sh. 10
	7.3-1 Sh. 10A
	7.3-1 Sh. 10B
	7.3-1 Sh. 10C
	7.3-1 Sh. 11
	7.3-1 Sh. 11A
	7.3-1 Sh. 12
	7.3-1 Sh. 13
	7.3-1 Sh. 13A
	7.3-1 Sh. 14
	7.3-1 Sh. 15
	7.3-1 Sh. 16
	7.3-1 Sh. 16A
	7.3-1 Sh. 16B
	7.3-1 Sh. 16C
	7.3-1 Sh. 16D

Remove	Insert
9.1-3	9.1-3
9.2-1	9.2-1
9.2-2	9.2-2
9.2-5	9.2-5
9.2-6	9.2-6
9.4-5	9.4-5
9.4-9	9.4-9
11.4-2	11.4-2

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 1

1-i		(0)	(1)							
1-ii		(0)								
1-iii		(0)								
1-iv		(0)								
1-v		(0)								
1.1-1		(0)	(1)							
1.1-2		(0)	(1)					(6)		
T1.1-1								(6)		
1.2-1		(0)							(7)	
1.2-2		(0)	(1)			(4)			(7)	
1.2-3		(0)	(1)						(7)	
1.2-4		(0)	(1)						(7)	
1.2-5		(0)	(1)						(7)	
1.2-6		(0)							(7)	
1.2-7		(0)	(1)						(7)	
1.2-8		(0)							(7)	
1.2-9		(0)							(7)	
1.2-10		(0)							(7)	
F1.2-1		(0)								
F1.2-2		(0)								
F1.2-3		(0)		(2)			(5)	(6)		
F1.2-4		(0)		(2)			(5)	(6)		
F1.2-5		(0)		(2)			(5)	(6)		
F1.2-6		(0)		(2)		(4)	(5)	(6)		
F1.2-7		(0)		(2)			(5)	(6)		
F1.2-8		(0)		(2)			(5)	(6)		
F1.2-9		(0)		(2)		(4)	(5)	(6)		
F1.2-10		(0)		(2)			(5)	(6)		
1.3-1		(0)								
T1.3-1	Sh. 1	(0)								
T1.3-1	Sh. 2	(0)								
T1.3-1	Sh. 3	(0)								
T1.3-1	Sh. 4	(0)								
T1.3-1	Sh. 5	(0)								
T1.3-1	Sh. 6	(0)	(1)							
1.4-1		(0)	(1)							
1.5-1		(0)								
1.6-1		(0)								
T1.6-1	Sh. 1	(0)			(3)					
T1.6-1	Sh. 2				(3)					
T1.6-2	Sh. 1	(0)								
T1.6-2	Sh. 2	(0)								
T1.6-2	Sh. 3	(0)								
T1.6-2	Sh. 4	(0)								
T1.6-2	Sh. 5	(0)								
T1.6-2	Sh. 6	(0)								
1.7-1		(0)								
1.8-1		(0)								
1.8-2		(0)								(8)

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 1

1.8.2a					(8)
T1.8-1	Sh. 1	(0)			
T1.8-1	Sh. 2	(0)			
T1.8-1	Sh. 3	(0)			
T1.8-1	Sh. 4	(0)			
T1.8-1	Sh. 5	(0)			
T1.8-1	Sh. 6	(0)			
T1.8-1	Sh. 7	(0)			
T1.8-1	Sh. 8	(0)	(1)		
T1.8-1	Sh. 9	(0)			
T1.8-1	Sh. 10	(0)			
T1.8-1	Sh. 11	(0)			
T1.8-1	Sh. 12	(0)			
T1.8-1	Sh. 13	(0)			
T1.8-1	Sh. 14	(0)			
T1.8-1	Sh. 15	(0)			
T1.8-1	Sh. 16	(0)			
T1.8-1	Sh. 17	(0)			
T1.8-1	Sh. 18	(0)			
T1.8-1	Sh. 19	(0)			
T1.8-1	Sh. 20	(0)			
T1.8-2	Sh. 1	(0)	(1)	(3) (4)	
T1.8-2	Sh. 1a			(3) (4-deleted)	(8)
T1.8-2	Sh. 2		(1)	(3) (4)	
T1.8-2	Sh. 2a			(3) (4-deleted)	
T1.8-2	Sh. 3		(1)	(3) (4)	
T1.8-2	Sh. 3a			(3) (4-deleted)	
T1.8-2	Sh. 4		(1)	(3) (4)	
T1.8-2	Sh. 5		(1)	(3) (4)	
T1.8-2	Sh. 6		(1)	(3) (4)	(8)
T1.8-2	Sh. 6a			(3) (4-deleted)	(8)
T1.8-2	Sh. 7		(1)	(3) (4)	(8)
T1.8-2	Sh. 8		(1)	(3) (4)	(8)
T1.8-2	Sh. 9		(1)	(3) (4)	(8)
T1.8-2	Sh. 10		(1)	(3) (4)	(8)
T1.8-2	Sh. 10a				(8)
T1.8-2	Sh. 11		(1)	(3) (4)	
T1.8-2	Sh. 11a			(3) (4-deleted)	
T1.8-2	Sh. 12		(1)	(3) (4)	
T1.8-2	Sh. 12a			(3) (4-deleted)	
T1.8-2	Sh. 13		(1)	(3) (4)	(8)
T1.8-2	Sh. 14		(1)	(3) (4-deleted)	
T1.8-2	Sh. 15		(1)	(3) (4-deleted)	
T1.8-2	Sh. 15a			(3) (4-deleted)	
T1.8-2	Sh. 16		(1)	(3) (4-deleted)	
T1.8-2	Sh. 17		(1)	(3) (4-deleted)	
T1.8-2	Sh. 18		(1)	(3) (4-deleted)	
T1.8-2	Sh. 18a			(3) (4-deleted)	
T1.8-2	Sh. 19		(1)	(3) (4-deleted)	

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 1

T1.8-2	Sh. 20		(1)		(3)	(4-deleted)			
T1.8-2	Sh. 21		(1)		(3)	(4-deleted)			
T1.8-2	Sh. 22		(1)		(3)	(4-deleted)			
T1.8-2	Sh. 22a				(3)	(4-deleted)			
T1.8-2	Sh. 23		(1)		(3)	(4-deleted)			
T1.8-2	Sh. 23a				(3)	(4-deleted)			
T1.8-2	Sh. 24		(1)		(3)	(4-deleted)			
T1.8-2	Sh. 24a				(3)	(4-deleted)			
T1.8-2	Sh. 25		(1)		(3)	(4-deleted)			
T1.8-2	Sh. 25a				(3)	(4-deleted)			
T1.8-2	Sh. 26		(1)		(3)	(4-deleted)			
T1.8-2	Sh. 26a				(3)	(4-deleted)			
T1.8-2	Sh. 27		(1)		(3)	(4-deleted)			
T1.8-2	Sh. 28		(1)		(3)	(4-deleted)			
T1.8-2	Sh. 29		(1)		(3)	(4-deleted)			
T1.8-2	Sh. 30		(1)		(3)	(4-deleted)			
T1.8-2	Sh. 31		(1)		(3)	(4-deleted)			
T1.8-2	Sh. 32		(1)		(3)	(4-deleted)			
T1.8-2	Sh. 32a				(3)	(4-deleted)			
T1.8-2	Sh. 32b				(3)	(4-deleted)			
T1.8-3	Sh. 1	(0)							
T1.8-3	Sh. 2	(0)						(7)	(8)
T1.8-3	Sh. 2a								(8)
T1.8-3	Sh. 3	(0)							(8)
T1.8-3	Sh. 3a								(8)
T1.8-3	Sh. 4	(0)							
T1.8-3	Sh. 5	(0)							
1.9-1		(0)	(1)		(3)	(4)			
1.9-1a					(3)	(4)			
1.9-1b					(3)	(4)			
1.9-2		(0)			(3)	(4)			
1.9-2a					(3)	(4)			
1.9-3		(0)			(3)	(4)			
1.9-3a					(3)	(4)			
1.9-3b					(3)	(4)			
1.9-4		(0)			(3)				
1.9-4a					(3)	(4)			
1.9-5		(0)			(3)	(4)			
1.9-5a					(3)	(4)			
F1.9-1		(0)		(2)			(6)		
2-i		(0)	(1)						
2-ii		(0)							
2-iii		(0)							
2-iv		(0)							
2-v		(0)							
2-vi		(0)							
2-vii		(0)	(1)						
2-viii		(0)							
2-ix		(0)							

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 1

2.1-1		(0)		
2.2-1		(0)		
2.3-1		(0)	(1)	
2.3-2		(0)		
2.3-3		(0)		
2.3-4		(0)	(1)	
2.3-5		(0)		(3)
2.3-6		(0)	(1)	(3)
2.3-7		(0)		(3)
2.3-8		(0)	(1)	
2.3-9		(0)	(1)	
2.3-9a			(1)	(3)
2.3-9b			(1)	
2.3-9c			(1)	
2.3-9d			(1)	
T2.3-1		(0)	(1)	(3)
T2.3-2		(0)	(1)	(3)
T2.3-3	Sh. 1	(0)	(1)	
T2.3-3	Sh. 2	(0)	(1)	
T2.3-3	Sh. 3	(0)	(1)	(3)
T2.3-4		(0)	(1)	(3)
T2.3-5		(0)		(3-deleted)
T2.3-6		(0)	(1)	(3-deleted)
T2.3-7		(0)		
T2.3-8		(0)		
T2.3-9		(0)		
T2.3-10		(0)		
T2.3-11		(0)		
T2.3-12		(0)		
T2.3-13		(0)		
T2.3-14		(0)		
T2.3-15		(0)		
T2.3-16		(0)		
T2.3-17		(0)		
F2.3-1		(0)		
F2.3-2		(0)		
F2.3-3		(0)		
F2.3-4		(0)		
F2.3-5		(0)	(1)	
F2.3-6		(0)	(1)	
F2.3-7		(0)	(1)	
2.4-1		(0)		
2.4-2		(0)		
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EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 1

2.4-9	(0)			
2.4-10	(0)			
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2.4-12	(0)			
2.4-13	(0)		(2)	
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2.5-1	(0)			
2.5-2	(0)			
2.5-3	(0)			
2.5-4	(0)			
2.5-5	(0)			(5)
2.5-6	(0)			
2.5-7	(0)			
2.5-8	(0)			
2.5-9	(0)			
2.5-10	(0)			
3-i	(0)			
3-ii	(0)			
3-iii	(0)			
3-iv	(0)			
3-v	(0)	(1)		
3-vi	(0)	(1)		
3-vii	(0)			
3-viii	(0)			
3-ix	(0)			
3-x	(0)	(1)		
3-xi	(0)	(1)		
3-xii	(0)		(2)	
3-xiia			(2)	
3-xiii	(0)			
3-xiv	(0)		(2)	
3-xv	(0)		(2)	
3-xvi	(0)		(2)	
3-xvia			(2)	
3-xvii	(0)			
3-xviii	(0)			
3.1-1	(0)			
3.1-2	(0)			
3.1-3	(0)			
3.1-4	(0)			
3.1-5	(0)	(1)		
3.1-6	(0)			
3.1-7	(0)			
3.1-8	(0)			
3.1-9	(0)			
3.1-10	(0)			
3.1-11	(0)			
3.1-12	(0)			
3.1-13	(0)			

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 1

3.1-14	(0)	(1)		
3.1-15	(0)			
3.1-16	(0)			
3.1-17	(0)			
3.1-18	(0)	(1)		
3.1-19	(0)			
3.1-20	(0)			
3.1-21	(0)			
3.1-22	(0)			
3.1-23	(0)			
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3.1-26	(0)			
3.1-27	(0)			
3.1-28	(0)			
3.1-29	(0)			
3.1-30	(0)			
3.1-31	(0)			
3.1-32	(0)			
3.1-33	(0)			
3.1-34	(0)			
3.1-35	(0)			
3.1-36	(0)			
3.1-37	(0)			
3.1-38	(0)			(4)
3.1-39	(0)			(4)
3.1-40	(0)			(4)
3.1-41	(0)			(4)
3.1-42	(0)			(4)
3.1-43	(0)			(4)
3.1-44	(0)			
3.1-45	(0)			
3.1-46	(0)			
3.1-47	(0)	(1)		
3.1-48	(0)	(1)	(3)	(4)
3.1-49	(0)	(1)		
3.1-50	(0)			
3.1-51	(0)			
3.1-52	(0)			
3.1-53	(0)			
3.1-54	(0)			
3.1-55	(0)	(1)		
3.1-56	(0)	(1)		
3.1-57	(0)			
3.1-58	(0)	(1)		
3.1-59	(0)			
3.1-60	(0)	(1)		
3.1-61	(0)			
3.1-62	(0)			

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 1

3.2-1		(0)								
3.1-2		(0)								
3.2-3		(0)				(4)				
3.2-3a						(4)				
T3.2-1	Sh. 1	(0)	(1)				(5)			
T3.2-1	Sh. 2	(0)	(1)				(5)			
T3.2-1	Sh. 3	(0)	(1)				(5)			
T3.2-1	Sh. 4	(0)	(1)		(3)		(5)			
T3.2-1	Sh. 4a			(2)	(3)		(5)			
T3.2-1	Sh. 5	(0)	(1)	(2)			(5)			
T3.2-1	Sh. 6	(0)	(1)				(5)			
T3.2-1	Sh. 7	(0)	(1)				(5)			(9)
T3.2-1	Sh. 7a						(5)	(6)		
T3.2-1	Sh. 7b							(6)		
T3.2-1	Sh. 8	(0)	(1)	(2)			(5)			(9)
T3.2-1	Sh. 9	(0)	(1)				(5)			
T3.2-1	Sh. 10	(0)	(1)				(5)			(9)
T3.2-1	Sh. 10a						(5)			
T3.2-1	Sh. 11	(0)	(1)				(5)			
T3.2-1	Sh. 12	(0)	(1)	(2)			(5)			
T3.2-1	Sh. 12a						(5)			
T3.2-1	Sh. 13	(0)	(1)	(2)			(5)	(6)		
T3.2-1	Sh. 13a			(2)			(5)	(6)		
T3.2-1	Sh. 14	(0)	(1)	(2)			(5)	(6)		
T3.2-1	Sh. 14a			(2)			(5)	(6)		
T3.2-1	Sh. 15	(0)	(1)	(2)			(5)	(6)		
T3.2-1	Sh. 15a			(2)			(5)	(6)		
T3.2-1	Sh. 16	(0)	(1)	(2)			(5)	(6)		
T3.2-1	Sh. 17	(0)	(1)				(5)	(6)		
T3.2-1	Sh. 17a						(5)			
T3.2-1	Sh. 18	(0)	(1)				(5)			
T3.2-1	Sh. 19	(0)	(1)				(5)			
T3.2-1	Sh. 20	(0)	(1)	(2)			(5)			
T3.2-1	Sh. 21	(0)	(1)				(5)	(6)		
T3.2-2		(0)	(1)							
T3.2-3	Sh. 1					(4)				
T3.2-3	Sh. 2					(4)				
3.3-1		(0)	(1)							
3.3-2		(0)	(1)				(5)			
3.3-3		(0)	(1)				(5)			
3.3-4		(0)	(1)				(5)			
3.3-5		(0)	(1)				(5)			
3.4-1		(0)					(5)	(6)		
3.4-1a								(6)		
3.4-2		(0)								
3.5-1		(0)							(7)	
3.5-1a									(7)	
3.5-2		(0)							(7)	
3.5-2a									(7)	

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 1

3.5-3		(0)						(7)		
3.5-3a								(7)		
3.5-4		(0)								
3.5-5		(0)	(1)	(2)						
3.5-6		(0)	(1)	(2)						
3.5-7		(0)					(6)	(7)		
3.5-7a							(6)	(7)		
3.5-8		(0)		(2)		(5)			(8)	
3.5-8a				(2)		(5)			(8)	
3.5-9		(0)	(1)	(2)		(5)				
T3.5-1		(0)	(1)							
T3.5-2	Sh. 1	(0)	(1)							
T3.5-2	Sh. 2	(0)	(1)							
T3.5-3		(0)	(1)							
T3.5-4		(0)	(1)							
T3.5-5		(0)	(1)							
T3.5-6		(0)	(1)							
T3.5-7		(0)								
T3.5-8		(0)								
T3.9-9		(0)	(1)	(2)						
T3.5-10		(0)			(4)					
T3.5-11	Sh. 1							(7)		
T3.5-11	Sh. 2							(7)		
T3.5-11	Sh. 3							(7)		
T3.5-11	Sh. 4							(7)		
F3.5-1		(0)								
F3.5-2		(0)								
F3.5-3		(0)								
F3.5-4		(0)			(4)					
3.6-1		(0)	(1)				(6)			
3.6-2		(0)	(1)				(6)			(9)
3.6-2a							(6)			
3.6-3		(0)	(1)					(7)		
3.6-3a								(7)		
3.6-3b								(7)		
3.6-4		(0)	(1)					(7)		
3.6-5		(0)	(1)	(2)				(7)		
3.6-5a								(7)		
3.6-5b								(7)		
3.6-6		(0)		(2)	(4)					(9)
3.6-7		(0)	(1)	(2-deleted)						
3.6-8		(0)		(2-deleted)						
3.6-9		(0)		(2-deleted)						
3.6-10		(0)		(2)	(4)		(6)			
3.6-11		(0)	(1)	(2)	(4-deleted)					
3.6-12		(0)	(1)	(2-deleted)						
3.6-13		(0)	(1)	(2-deleted)						
3.6-14		(0)		(2)						
3.6-15		(0)		(2)						

3.6-15a				(2)	(4)					
3.6-16		(0)	(1)	(2)						
3.6-16a				(2)						
3.6-17		(0)	(1)							
3.6-18		(0)								
3.6-19		(0)								
3.6-20		(0)					(6)	(7)		
3.6-20a							(6)	(7)		
3.6-20b							(6)			
3.6-21		(0)		(2)	(4)					
3.6-21a				(2)	(4)					
3.6-22		(0)		(2)						
3.6-23		(0)								
3.6-24		(0)								
T3.6-1	Sh. 1	(0)	(1)				(6)			(9)
T3.6-1	Sh. 2	(0)	(1)				(6)			(9)
T3.6-1	Sh. 3						(6)			
T3.6-2	Sh. 1	(0)						(7)		
T3.6-2	Sh. 2							(7)		
T3.6-3		(0)								
F3.6-1.1		(0)		(2-deleted)						
F3.6-1.2		(0)		(2-deleted)						
F3.6-1A				(2)						
F3.6-1B				(2)						
F3.6-2		(0)								
F3.6-3		(0)								
F3.6-4		(0)								
F3.6-5		(0)								
F3.6-6				(2)						
F3.6-7				(2)						
F3.6-8							(6)			
F3.6-9							(6)			
F3.6-10							(6)			
F3.6-11							(6)			
F3.6-12							(6)			
F3.6-13							(6)			
F3.6-14							(6)			
3.7-1		(0)		(2)	(4)	(5)			(8)	
3.7-1a				(2)						
3.7-2		(0)		(2)						
3.7-3		(0)	(1)	(2)		(5)	(6)			
3.7-3a				(2)		(5)				
3.7-4		(0)	(1)							
3.7-5		(0)					(6)			
3.7-6		(0)					(6)			
3.7-7		(0)		(2)		(5)				
3.7-7a				(2)						
3.7-8		(0)								
3.7-9		(0)			(4)				(8)	

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 1

3.7-9a				(4)			
3.7-10	(0)	(1)	(2)	(4)	(5)		
3.7-10a				(4)			
3.7-11	(0)	(1)			(5)		
3.7-12	(0)				(5)		
3.7-12a					(5)		
3.7-13	(0)	(1)			(5)		
3.7-14	(0)						
3.7-15	(0)						(8)
3.7-16	(0)	(1)			(5)		(8)
3.7-17	(0)				(5)		(8)
3.7-18	(0)	(1)			(5)		(8)
3.7-19	(0)	(1)			(5)		
3.7-20	(0)				(5)		(8)
3.7-20a					(5)		(8)
3.7-21	(0)			(4)	(5)		
3.7-22	(0)			(4)	(5)	(6)	
3.7-23	(0)						
3.7-24	(0)			(4)	(5)		(8)
3.7-25	(0)				(5)		
3.7-26	(0)				(5)		
3.7-26a					(5)		
3.7-27	(0)				(5)		
3.7-28	(0)	(1)					
3.7-29	(0)				(5)		
3.7-30	(0)	(1)			(5)		(8)
2.7-30a					(5)		
3.7-31	(0)				(5)		
3.7-31a					(5)		
3.7-32	(0)						
3.7-33	(0)				(5)		
3.7-34	(0)	(1)			(5)		
3.7-35	(0)						
3.7-36	(0)				(5)		
3.7-37	(0)						
3.7-38	(0)						
3.7-39	(0)						
3.7-40	(0)						
3.7-41	(0)					(6)	
3.7-42	(0)						
3.7-43	(0)	(1)					
3.7-44	(0)				(5)		
3.7-45	(0)	(1)					
3.7-46	(0)						
3.7-47	(0)				(5)		
3.7-48	(0)						
3.7-49	(0)						
3.7-50	(0)					(6)	(8)
T3.7-1	(0)	(1)					

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 1

T3.7-2	Sh. 1	(0)	
T3.7-2	Sh. 2	(0) (1)	
T3.7-3		(0)	
T3.7-4		(0)	
T3.7-5		(0) (1)	
T3.7-6	Sh. 1	(0) (1)	
T3.7-6	Sh. 2	(0) (1)	
3.7A-1		(0)	(6)
3.7A-2		(0)	(6)
3.7A-3		(0) (1)	(6)
3.7A-4		(0)	(6)
3.7A-5		(0) (1)	(6)
3.7A-6		(0)	(6)
3.7A-7		(0)	(6)
3.7A-8		(0) (1)	(6)
3.7A-9		(0)	(6)
3.7A-10		(0)	(6)
3.7A-11		(0)	(6)
3.7A-12		(0)	(6)
3.7A-13		(0) (1)	(6)
3.7A-14		(0) (1)	(6)
3.7A-15		(0) (1)	(6)
3.7A-16		(0)	(6)
3.7A-17		(0)	(6)
3.7A-18		(0)	(6)
3.7A-19		(0)	(6)
3.7A-20		(0)	(6)
3.7A-21		(0)	(6)
3.7A-22		(0) (1)	(6-deleted)
3.7A-23		(0)	(6-deleted)
3.7A-24		(0)	(6-deleted)
3.7A-25		(0)	(6-deleted)
3.7A-26		(0)	(6-deleted)
3.7A-27		(0)	(6-deleted)
3.7A-28		(0)	(6-deleted)
3.7A-29		(0)	(6-deleted)
3.7A-30		(0)	(6-deleted)
3.7A-31		(0)	(6-deleted)
T3.7A-1	Sh. 1	(0) (1)	(6)
T3.7A-1	Sh. 2	(0) (1)	(6)
F3.7-1		(0)	
F3.7-2		(0)	
F3.7-3		(0)	
F3.7-4		(0)	
F3.7-5		(0)	
F3.7-6		(0)	
F3.7-7		(0)	
F3.7-8		(0)	
F3.7-9		(0)	

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 1

F3.7-10	(0)	
F3.7-11	(0)	
F3.7-12	(0)	
F3.7-13	(0)	
F3.7-14	(0)	
F3.7-15	(0)	
F3.7-16	(0)	
F3.7-17	(0)	
F3.7-18		(5)
F3.7A-1	(0)	

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 2

3.8-1	(0)			(4)		
3.8-2	(0)			(4)		
3.8-3	(0)					
3.8-4	(0)					
3.8-5	(0)			(4)		
3.8-6	(0)			(4)		
3.8-7	(0)					
3.8-8	(0)					
3.8-9	(0)					
3.8-10	(0)					
3.8-11	(0)					
3.8-12	(0)				(5)	
3.8-13	(0)					
3.8-14	(0)				(5)	
3.8-14a					(5)	
3.8-15	(0)	(1)				
3.8-16	(0)	(1)			(5)	
3.8-16a					(5)	(8)
3.8-17	(0)					
3.8-18	(0)				(5)	
3.8-19	(0)	(1)				
3.8-20	(0)	(1)				
3.8-21	(0)					
3.8-22	(0)				(5)	
3.8-22a					(5)	
3.8-23	(0)					
3.8-24	(0)					
3.8-25	(0)				(5)	
3.8-26	(0)			(4)		
3.8-27	(0)					(8)
3.8-27a						(8)
3.8-28	(0)	(1)			(5)	
3.8-28a					(5)	
3.8-29	(0)					
3.8-30	(0)					
3.8-31	(0)					
3.8-32	(0)					
3.8-33	(0)					
3.8-34	(0)					
3.8-35	(0)					
3.8-36	(0)					
3.8-37	(0)					
3.8-38	(0)					
3.8-39	(0)			(4)		
3.8-40	(0)		(3)	(4)		
3.8-41	(0)			(4)		
3.8-42	(0)					
3.8-43	(0)	(1)		(4)		
3.8-44	(0)					

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 2

3.8-45	(0)	(1)		(4)	
3.8-46	(0)	(1)		(4)	
3.8-47	(0)				
3.8-48	(0)				
3.8-49	(0)				
3.8-50	(0)				
3.8-51	(0)			(4)	
3.8-52	(0)			(4)	
3.8-53	(0)				
3.8-54	(0)				(5)
3.8-55	(0)	(1)			(5)
3.8-56	(0)				
3.8-57	(0)	(1)			
3.8-58	(0)				(5)
3.8-58a					(5)
3.8-59	(0)	(1)			
3.8-60	(0)				
3.8-61	(0)				(5)
3.8-61a					(5)
3.8-62	(0)				
3.8-63	(0)	(1)			
3.8-64	(0)	(1)			(5)
3.8-65	(0)	(1)			
3.8-66	(0)				
3.8-67	(0)				
3.8-68	(0)	(1)	(2)		
3.8-68a			(2)		
3.8-69	(0)			(4)	
3.8-70	(0)				(5)
3.8-71	(0)	(1)			
3.8-72	(0)			(4)	(5)
3.8-73	(0)			(4)	
3.8-74	(0)				
3.8-75	(0)				
3.8-76	(0)	(1)			
3.8-77	(0)				
3.8-78	(0)				
3.8-79	(0)				
3.8-80	(0)				
3.8-81	(0)				
3.8-82	(0)				(5)
3.8-83	(0)				
3.8-84	(0)				
3.8-85	(0)				
3.8-86	(0)				
3.8-87	(0)				
3.8-88	(0)				
3.8-89	(0)				(5)
3.8-89a					(5)

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 2

3.8-90		(0)					(5)	(6)	
3.8-90a							(5)	(6)	
3.8-91		(0)						(6)	
3.8-92		(0)							
3.8-93		(0)				(4)			
3.8-94		(0)					(5)		
3.8-95		(0)							
T3.8-1	SH.1	(0)							
T3.8-1	SH.2	(0)	(1)						
F3.8-1		(0)			(3)			(6-deleted)	
F3.8-1A								(6)	
F3.8-1B								(6)	
F3.8-1C								(6)	
F3.8-1D								(6)	
F3.8-1E								(6)	
F3.8-1F								(6)	
F3.8-1G								(6)	
F3.8-1H								(6)	
F3.8-2		(0)			(3)		(5)	(6)	(8)
F3.8-3		(0)			(3)			(6)	
F3.8-4		(0)			(3)				
F3.8-5		(0)				(4)			
F3.8-6		(0)							
F3.8-7		(0)						(6)	
F3.8-8		(0)							
F3.8-9		(0)							
F3.8-10		(0)							
F3.8-11		(0)					(5)		
F3.8-12		(0)							
F3.8-13		(0)					(5)		
F3.8-14		(0)							
F3.8-15		(0)							
3.9-1		(0)							
3.9-2		(0)		(2)					
3.9-2a				(2)					
3.9-3		(0)		(2)					
3.9-4		(0)		(2)					
3.9-5		(0)		(2)					
3.9-6		(0)	(1)	(2)					
3.9-6a				(2)					
3.9-7		(0)	(1)	(2)					
3.9-8		(0)		(2)					
3.9-8a				(2)					
3.9-9		(0)		(2)					
3.9-10		(0)	(1)	(2)					
3.9-11		(0)		(2)					
3.9-12		(0)		(2)					
3.9-13		(0)	(1)	(2)					
3.9-14		(0)		(2)					

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 2

3.9-15		(0)						
3.9-16		(0)	(1)					
3.9-17		(0)	(1)	(2)				
3.9-18		(0)						
3.9-19		(0)	(1)	(2)	(4)			
3.9-19a				(2)	(4-deleted)			
3.9-20		(0)			(4)			
3.9-21		(0)		(2)				
3.9-21a				(2)				
3.9-22				(2)				
T3.9-1	SH.1	(0)		(2)				
T3.9-1	SH.2	(0)		(2)				
T3.9-2	SH.1	(0)		(2)	(4)		(7)	
T3.9-2	SH.2			(2)	(4)		(7)	
T3.9-2	SH.3			(2)			(7)	
T3.9-2	SH.4						(7)	
T3.9-3	SH.1	(0)	(1)	(2)	(4)		(7)	
T3.9-3	SH.2	(0)	(1)	(2)	(4)		(7)	
T3.9-3	SH.3	(0)	(1)	(2)	(4)			
T3.9-3	SH.4	(0)	(1)	(2)	(4)			
T3.9-4	SH.1	(0)	(1)	(2)				
T3.9-4	SH.2	(0)	(1)	(2)				
T3.9-4	SH.3	(0)	(1)	(2)				
T3.9-5	SH.1	(0)	(1)	(2)		(5)		
T3.9-5	Sh.1a			(2)		(5)		
T3.9-5	SH.2	(0)	(1)	(2)		(5)	(7)	
T3.9-5	SH.2a					(5)		
T3.9-5	SH.3	(0)	(1)	(2)		(5)	(7)	
T3.9-5	SH.4	(0)	(1)	(2)		(5)		
T3.9-5	SH.4a			(2)		(5)		
T3.9-5	SH.4b					(5)	(7)	
(UNNUMBERED PAGE)		(0)		(2-deleted)				
F3.9-1		(0)						
F3.9-2		(0)						
F3.9-3		(0)						
F3.9-4		(0)						
F3.9-5		(0)						
F3.9-6		(0)						
F3.9-7		(0)						
F3.9-8		(0)						
3.10-1		(0)						(9)
3.10-1a								(9)
3.10-2		(0)		(2)				(9)
3.10-3		(0)	(1)	(2)				
3.11-1		(0)	(1)					
3.11-2		(0)						
3.11-3		(0)	(1)					
3.11-4		(0)						
3.11-5		(0)						

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 2

3.11-6		(0)					
3.11-7		(0)					
3.11-8		(0)	(1)				
3.11-9		(0)	(1)				
3.11-10		(0)	(1)				
3.11-11		(0)	(1)				
3.11-12		(0)					
3.11-13		(0)	(1)				
T3.11-1	SH.1	(0)					
T3.11-1	SH.2	(0)					
T3.11-2		(0)	(1)				
T3.11-3	SH.1	(0)					(8)
T3.11-3	SH.2	(0)					(8-deleted)
T3.11-4	SH.1	(0)					(8)
T3.11-4	SH.2						(8)
T3.11-5	SH. 1				(6)		(8)
T3.11-5	SH. 2				(6)		
F3.11-1							(8)
F3.11-2							(8)
4-i		(0)					
5-i		(0)	(1)	(5)			
5-ii		(0)	(1)	(5)			
5-iia				(5)			
5-iii		(0)					
5-iv		(0)					
5-v			(1)	(5)			
5.1-1		(0)					
T5.1-1		(0)					
5.2-1		(0)	(1)	(5)			
5.2-1a				(5)			
5.2-1b				(5)			
5.2-1c				(5)			
5.2-2		(0)					
5.2-3		(0)					
5.2-4		(0)		(5)			
5.2-4a				(5)			
5.2-5		(0)		(5)			
5.2-5a				(5)			
5.2-5b				(5)		(7)	
5.2-5c				(5)		(7)	
5.2-5d				(5)		(7)	
5.2-6		(0)		(5)		(7)	
5.2-7		(0)		(5)		(7)	
5.2-7a				(5)		(7)	
5.2-8		(0)		(5)		(7)	
5.2-8a				(5)		(7)	
5.2-9		(0)		(5)		(7)	
5.2-10		(0)		(5)		(7)	
5.2-11		(0)		(5)		(7)	

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 2

5.2-12		(0)					(5)		(7)		
T5.2-1							(5)		(7)		
T5.2-2									(7)		
F5.2-1		(0)					(5-deleted)				
5.3-1		(0)									
5.4-1		(0)									
5.4-2		(0)		(2)							
T5.4-1		(0)									
(UNNUMBERED CONTENTS PAGES)		(0)	(1-deleted)								
6-i			(1)								
6-ii			(1)								
6-iii			(1)								
6-iv			(1)	(2)							
6-iva			(1)								
6-v			(1)								
6-vi			(1)								
6-vii			(1)	(2)							
6-viii			(1)	(2)							
6-viiia				(2)							
6-ix			(1)								
6-x			(1)								
6-xi			(1)	(2)							
6-xia				(2)							
6-xii			(1)								
6.1-1		(0)									
6.1-2		(0)	(1)								
6.1-3		(0)	(1)								
6.1-4		(0)	(1)					(6)			
6.1-5		(0)									
6.1-6		(0)									
T6.1-1	SH.1	(0)			(3)						
T6.1-1	SH.2				(3)						
T6.1-1	SH.3				(3)						
T6.1-2	SH.1	(0)	(1)								
T6.1-2	SH.2	(0)	(1)								
T6.1-3		(0)	(1)								
T6.1-4		(0)	(1)								
T6.1-5		(0)									
T6.1-6		(0)				(4)					(9)
T6.1-7		(0)	(1)								
T6.1-8		(0)									
6.2-1		(0)	(1)				(5)		(7)	(8)	
6.2-1a									(7)		
6.2-2		(0)	(1)				(5)		(7)		
6.2-2a							(5)		(7)		
6.2-3		(0)							(7)		
6.2-4		(0)	(1)						(7)	(8)	
6.2-5		(0)	(1)						(7)	(8)	

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 2

6.2-6	(0)					(7)		
6.2-7	(0)					(7)		
6.2-7a						(7)		
6.2-8	(0)					(7)		
6.2-9	(0)	(1)				(7)		
6.2-9a						(7)	(8)	
6.2-10	(0)	(1)				(7)	(8)	
6.2-10a							(8)	
6.2-11	(0)					(7)	(8)	
6.2-12	(0)					(7)	(8)	
6.2-13	(0)	(1)						
6.2-14	(0)							
6.2-15	(0)	(1)						
6.2-16	(0)	(1)	(2)				(8)	
6.2-16a							(8)	
6.2-17	(0)	(1)					(8)	
6.2-18	(0)						(8)	
6.2-19	(0)							
6.2-20	(0)	(1)						
6.2-21	(0)							
6.2-22	(0)	(1)						
6.2-23	(0)	(1)						(9)
6.2-24	(0)	(1)						(9)
6.2-25	(0)	(1)		(4)				(9)
6.2-25a				(4)				(9)
6.2-26	(0)	(1)		(4)		(7)		(9)
6.2-27	(0)	(1)		(4)		(7)		(9)
6.2-28	(0)	(1)		(4)		(7)		(9)
6.2-29	(0)	(1)		(4)	(6)	(7)		(9)
6.2-29a				(4)	(6)	(7)		
6.2-29b					(6)	(7)		(9)
6.2-29c						(7)		(9)
6.2-30	(0)		(2)	(4)		(7)		
6.2-31	(0)	(1)						
6.2-32	(0)	(1)						
6.2-33	(0)	(1)						
6.2-34	(0)	(1)						
6.2-35	(0)	(1)						
6.2-36	(0)	(1)						
6.2-37	(0)	(1)						
6.2-38	(0)							
6.2-39	(0)	(1)						
6.2-40	(0)							
6.2-41	(0)							
6.2-42	(0)	(1)						
6.2-42a		(1)						
6.2-43	(0)	(1)						
6.2-44	(0)	(1)						

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 2

6.2-45		(0)								
6.2-46		(0)	(1)				(6)			
6.2-47		(0)	(1)				(6)			(9)
6.2-47a										(9)
6.2-48		(0)	(1)							(9)
6.2-49		(0)	(1)				(6)			(9)
6.2-49a							(6)			
6.2-50		(0)			(3)		(6)			
6.2-50a					(3)		(6-deleted)			
6.2-51		(0)			(3)		(6)			
6.2-52		(0)			(3)		(6)			
6.2-52a					(3)		(6-deleted)			
6.2-53		(0)			(3)		(6)			
6.2-54		(0)	(1)							
6.2-55		(0)	(1)							
6.2-56		(0)								
6.2-57		(0)								
6.2-58		(0)	(1)							
6.2-59		(0)								
T6.2-1		(0)						(7)	(8)	
T6.2-2		(0)				(4)		(7)		
T6.2-3		(0)	(1)			(4)		(7)		
T6.2-4	SH.1	(0)	(1)			(4)		(7)		
T6.2-4	SH.2							(7)		
T6.2-5		(0)							(8)	
T6.2-6	SH.1	(0)	(1)					(7)	(8)	
T6.2-6	SH.2	(0)	(1)					(7)	(8)	
T6.2-6	SH.3							(7)	(8)	
T6.2-7	SH.1	(0)	(1)					(7)		
T6.2-7	SH.2	(0)	(1)					(7)		
T6.2-7	SH.3							(7)		
T6.2-8		(0)								
T6.2-9		(0)				(4)		(7)		
T6.2-10A		(0)	(1)					(7)		
T6.2-10B								(7)		
T6.2-10C								(7)		
T6.2-10D								(7)		
T6.2-11		(0)	(1)						(8)	
T6.2-12		(0)	(1)						(8)	
T6.2-13		(0)	(1)	(2)						
T6.2-14	SH.1								(8)	
T6.2-14	SH.2								(8)	
T6.2-14a	SH.1	(0)							(8-deleted)	
T6.2-14a	SH.2	(0)							(8-deleted)	
T6.2-14a	SH.3	(0)							(8-deleted)	
T6.2-14a	SH.4	(0)							(8-deleted)	
T6.2-14a	SH.5	(0)							(8-deleted)	
T6.2-14a	SH.6	(0)							(8-deleted)	
T6.2-14a	SH.7	(0)							(8-deleted)	

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 2

T6.2-14a	SH.8	(0)	(8-deleted)
T6.2-14a	SH.9	(0)	(8-deleted)
T6.2-14a	SH.10	(0)	(8-deleted)
T6.2-14a	SH.11	(0)	(8-deleted)
T6.2-14a	SH.12	(0)	(8-deleted)
T6.2-14a	SH.13	(0)	(8-deleted)
T6.2-14b	SH.1	(0)	(8-deleted)
T6.2-14b	SH.2	(0)	(8-deleted)
T6.2-14b	SH.3	(0)	(8-deleted)
T6.2-14b	SH.4	(0)	(8-deleted)
T6.2-14b	SH.5	(0)	(8-deleted)
T6.2-14b	SH.6	(0)	(8-deleted)
T6.2-14b	SH.7	(0)	(8-deleted)
T6.2-14b	SH.8	(0)	(8-deleted)
T6.2-14c	SH.1	(0)	(8-deleted)
T6.2-14c	SH.2	(0)	(8-deleted)
T6.2-14c	SH.3	(0)	(8-deleted)
T6.2-14c	SH.4	(0)	(8-deleted)
T6.2-14c	SH.5	(0)	(8-deleted)
T6.2-14d	SH.1	(0)	(8-deleted)
T6.2-14d	SH.2	(0)	(8-deleted)
T6.2-14d	SH.3	(0)	(8-deleted)
T6.2-14d	SH.4	(0)	(8-deleted)
T6.2-14d	SH.5	(0)	(8-deleted)
T6.2-14d	SH.6	(0)	(8-deleted)
T6.2-14d	SH.7	(0)	(8-deleted)
T6.2-14d	SH.8	(0)	(8-deleted)
T6.2-14d	SH.9	(0)	(8-deleted)
T6.2-14e	SH.1	(0)	(8-deleted)
T6.2-14e	SH.2	(0)	(8-deleted)
T6.2-14e	SH.3	(0)	(8-deleted)
T6.2-14e	SH.4	(0)	(8-deleted)
T6.2-14e	SH.5	(0)	(8-deleted)
T6.2-15a	SH.1	(0) (1)	
T6.2-15a	SH.2	(0) (1)	
T6.2-15a	SH.3	(0) (1)	
T6.2-15a	SH.4	(0) (1)	
T6.2-15b		(0) (1)	
T6.2-15c		(0) (1)	
T6.2-15d		(0) (1) (2)	
T6.2-16a	SH.1	(0) (1)	
T6.2-16a	SH.2	(0) (1)	
T6.2-16a	SH.3	(0) (1)	
T6.2-16a	SH.4	(0) (1)	
T6.2-16b		(0) (1)	
T6.2-16c		(0) (1)	
T6.2-16d		(0) (1)	
T6.2-17a	SH.1	(0) (1)	
T6.2-17a	SH.2	(0) (1)	

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 2

T6.2-17a	SH.3	(0)	(1)								
T6.2-17b		(0)	(1)								
T6.2-17c		(0)	(1)								
T6.2-17d		(0)	(1)								
T6.2-17e		(0)	(1)	(2)							
T6.2-18	SH.1	(0)				(4)					
T6.2-18	SH.2	(0)		(2)		(4)					
T6.2-18	Sh.2a					(4)					
T6.2-18	SH.3	(0)		(2)							
T6.2-19	SH.1	(0)				(4)	(5)				
T6.2-19	SH.1A	(0)									
T6.2-19	SH.2	(0)	(1)	(2)	(3)		(5)				
T6.2-19	SH.2A	(0)		(2)			(5)				
T6.2-19	SH.3	(0)	(1)				(5)				
T6.2-19	SH.3A	(0)	(1)				(5)				
T6.2-19	SH.4	(0)	(1)				(5)				
T6.2-19	SH.4a						(5)				
T6.2-19	SH.4A	(0)	(1)				(5)				
T6.2-19	SH.4Aa						(5)				
T6.2-19	SH.5	(0)	(1)	(2)			(5)				
T6.2-19	SH.5a						(5)				
T6.2-19	SH.5A	(0)	(1)				(5)				
T6.2-19	SH.6	(0)	(1)				(5)				(9)
T6.2-19	SH.6A	(0)	(1)				(5)				(9)
T6.2-19	SH.7	(0)	(1)			(4)	(5)				
T6.2-19	SH.7A	(0)	(1)			(4)	(5)				
T6.2-19	SH.8	(0)	(1)				(5)				
T6.2-19	SH.8a						(5)				
T6.2-20		(0)									
T6.2-21		(0)									
T6.2-22		(0)									
T6.2-23	SH.1	(0)									
T6.2-23	SH.2	(0)	(1)								
T6.2-23	SH.3	(0)	(1)	(2)							
T6.2-23	SH.3a			(2)							
T6.2-23	SH.4	(0)									
T6.2-24		(0)			(3-deleted)						
T6.2-25		(0)		(2)							
T6.2-26				(2)							
T6.2-27				(2)							
T6.2-28	SH.1			(2)							
T6.2-28	SH.2			(2)							
T6.2-29									(7)		
T6.2-30									(7)		
T6.2-31									(7)		
F6.2-1		(0)									
F6.2-2		(0)									
F6.2-3		(0)									
F6.2-4		(0)									

F6.2-5		(0)						
F6.2-6		(0)						
F6.2-7		(0)						
F6.2-8		(0)						
F6.2-9		(0)						
F6.2-10		(0)						
F6.2-11		(0)						
F6.2-12		(0)						
F6.2-13		(0)					(8-deleted)	
F6.2-14		(0)					(8-deleted)	
F6.2-15		(0)					(8-deleted)	
F6.2-16		(0)					(8-deleted)	
F6.2-17		(0)					(8-deleted)	
F6.2-17A							(8)	
F6.2-17B							(8)	
F6.2-18		(0)					(8-deleted)	
F6.2-19		(0)					(8-deleted)	
F6.2-20		(0)					(8-deleted)	
F6.2-21A		(0)						
F6.2-21B	SH. 1	(0)						
F6.2-21B	SH. 2					(6)		
F6.2-21B	SH. 3					(6)		
F6.2-21C		(0)						
F6.2-21D		(0)		(2)				
F6.2-22A		(0)						
F6.2-22B		(0)						
F6.2-22C	SH. 1	(0)		(2)				
F6.2-22C	SH. 2					(6)		
F6.2-22C	SH. 3					(6)		
F6.2-22D		(0)		(2)				
F6.2-22E		(0)		(2)				
F6.2-23A		(0)						
F6.2-23B	SH. 1	(0)						
F6.2-23B	SH. 2					(6)		
F6.2-23B	SH. 3					(6)		
F6.2-23C	SH. 1	(0)						
F6.2-23C	SH. 2					(6)		
F6.2-23C	SH. 3					(6)		
F6.2-23D		(0)						
F6.2-23E		(0)						
F6.2-23F				(2)				
F6.2-24		(0)						
F6.2-25		(0)		(2)				(9)
F6.2-26		(0)						
F6.2-27		(0)				(6)		
F6.2-28	SH.1	(0)			(5)	(6)		
F6.2-28	SH.2	(0)	(1)		(5)	(6)		
F6.2-28	SH.3	(0)		(2)	(5)	(6)		
F6.2-28	SH.4	(0)		(2)	(5)	(6)		

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 2

F6.2-28	SH.5	(0)					(6)		
F6.2-29		(0)	(1)						
F6.2-30			(1)						
F6.2-31			(1)						
F6.2-32			(1)						
F6.2-33			(1)						
F6.2-34			(1)						
F6.2-35							(6)		
6.3-1		(0)				(5)			
6.4-1		(0)	(1)	(2)					
6.4-2		(0)	(1)	(2)					
6.4-3		(0)							
6.4-4		(0)	(1)	(2)					
6.4-5		(0)	(1)	(2)					
6.4-5a				(2)					
6.4-6		(0)	(1)	(2)					
6.4-7		(0)	(1)	(2)		(5)			
6.4-7a						(5)			
6.4-8		(0)	(1)	(2)					
6.4-9		(0)	(1)	(2)					
6.4-9a				(2)					
6.4-10			(1)						
T6.4-1		(0)							
T6.4-2		(0)							
T6.4-3	SH.1	(0)		(2)					
T6.4-3	SH.2	(0)		(2)					
F6.4-1		(0)							
6.5-1		(0)	(1)		(4)			(8)	
6.5-2		(0)	(1)		(4)			(8)	
6.5-2a								(8)	
6.5-3		(0)	(1)		(4)				
6.5-4		(0)	(1)		(4)				(9)
6.5-5		(0)	(1)		(4)				(9)
6.5-5a									(9)
6.5-6		(0)	(1)		(4)				(9)
6.5-7		(0)	(1)		(4)				(9)
6.5-7a									(9)
6.5-8		(0)	(1)		(4)				(9)
6.5-9		(0)	(1)		(4)				(9)
6.5-10		(0)	(1)		(4)				(9)
6.5-10a									(9)
6.5-11		(0)	(1)		(4)				
6.5-12		(0)	(1)		(4)				
6.5-13		(0)	(1)		(4)				
6.5-14		(0)	(1)		(4)				
6.5-15		(0)	(1)		(4-deleted)				
6.5-16		(0)	(1)		(4-deleted)				
6.5-17		(0)	(1)		(4)				(9)
6.5-18		(0)	(1)						(9)

EFFECTIVE PAGE LISTING
GIBSSAR: VOLUME 2

6.5-19		(0)	(1)	(4)		(6)		(9)
6.5-19a				(4)				(9)
6.5-20		(0)	(1)					
6.5-21		(0)	(1)	(4)				
6.5-22		(0)	(1)	(4)				
T6.5-1	SH.1	(0)		(4)		(6)	(8)	
T6.5-1	SH.1a						(8)	
T6.5-1	SH.2	(0)		(4)		(6)	(8)	
T6.5-1	SH.3	(0)		(4)		(6)	(8)	
T6.5-1	SH.3a						(8)	
T6.5-1	SH.4	(0)		(4)		(6)	(8)	
T6.5-1	SH.5	(0)		(4)		(6)		
T6.5-1	SH.5a						(8)	
T6.5-1	SH.6	(0)		(4)		(6)	(8)	
T6.5-1	SH.6a						(8)	
T6.5-1	SH.7	(0)		(4)		(6)	(8)	
T6.5-1	SH.8	(0)		(4)		(6)	(8)	
T6.5-1	SH.9	(0)		(4)		(6)	(8)	
T6.5-1	SH.10	(0)		(4)		(6)	(8)	
T6.5-1	SH.11	(0)		(4)		(6-deleted)		
T6.5-1	SH.12	(0)		(4)		(6-deleted)		
T6.5-1	SH.13	(0)		(4)		(6-deleted)		
T6.5-1	SH.14	(0)		(4)		(6-deleted)		
T6.5-1	SH.15	(0)		(4)		(6-deleted)		
T6.5-2		(0)	(1)	(4)				
T6.5-3		(0)				(6)		(9)
T6.5-4	SH.1	(0)						(9)
T6.5-4	SH.2	(0)						(9)
T6.5-5		(0)		(4)				
T6.5-6		(0)		(4)				(9)
T6.5-7					(5)			(9)
F6.5-1		(0)						
F6.5-2		(0)						
F6.5-3					(5)			
F6.5-4		(0)			(5)			
6.6-1		(0)						
(UNNUMBERED PAGE)		(0)						

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 3

7-i		(0)	(1)	(2)							
7-ii		(0)		(2)	(3)						
7-iii		(0)									(9)
7-iv		(0)	(1)	(2)							(9)
7-iva											(9)
7-ivb											(9)
7-ivc											(9)
7.1-1		(0)	(1)								
7.1-2		(0)	(1)								
7.1-3		(0)	(1)		(3)						
7.1-4		(0)	(1)		(3)						(9)
7.1-5		(0)	(1)								(9)
7.1-6		(0)	(1)								
7.1-7			(1)								
7.1-8			(1)								
7.1-9			(1)		(3)						
7.1-10			(1)								
7.1-11			(1)								
7.1-12			(1)								
7.1-13			(1)								
7.1-14			(1)		(3)	(4)					
7.1-15			(1)								
7.1-16			(1)								
7.1-17			(1)								
7.1-18			(1)								
T7.1-1	Sh. 1									(8)	
T7.1-1	Sh. 2									(8)	
T7.1-1	Sh. 3									(8)	
T7.1-1	Sh. 4									(8)	
T7.1-1	Sh. 5									(8)	
T7.1-1	Sh. 6									(8)	
T7.1-1	Sh. 7									(8)	
T7.1-1	Sh. 8									(8)	
T7.1-1	Sh. 9									(8)	
T7.1-1	Sh. 10									(8)	
7.2-1		(0)	(1)								
7.3-1		(0)	(1)		(3)		(5)	(6)			
7.3-2		(0)	(1)				(5)				
7.3-2a			(1)								
7.3-3		(0)	(1)				(5)	(6)			(9)
7.3-3a								(6)			(9)
7.3-4		(0)	(1)					(6)			(9)
7.3-4a								(6)			
7.3-5		(0)	(1)								
7.3-6		(0)	(1)		(3)						
7.3-7		(0)			(3-deleted)						
7.3-8		(0)	(1)		(3)			(6)			
7.3-9		(0)	(1)								
7.3-10		(0)	(1)		(3)			(6)			(9)
7.3-11		(0)	(1)		(3)						
7.3-12		(0)	(1)		(3)						

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 3

7.3-13		(0)		(2)			(5)		
7.3-14		(0)	(1)	(2)	(3)				
7.3-14a				(2)					
7.3-15		(0)		(2)	(3)		(5)	(6)	
7.3-15a			(1)				(5)	(6)	
7.3-16		(0)	(1)					(6)	
7.3-16a								(6)	
7.3-17		(0)	(1)						(9)
7.3-18		(0)	(1)	(2)					
7.3-19				(2)	(3)				
7.3-20				(2)					
7.3-21				(2)					
7.3-22				(2)	(3)				
7.3-23				(2)	(3)				
7.3-24				(2)	(3)				
7.3-25				(2)	(3)				
7.3-26				(2)	(3)				
F7.3-1	SH. 1	(0)							(9)
F7.3-1	SH. 2	(0)							(9)
F7.3-1	SH. 3-9	(0)	(1)						(9)-deleted
F7.3-1	SH. 10	(0)	(1)					(6)	(9)
F7.3-1	SH. 11	(0)		(2)					(9)
F7.3-1	SH. 12	(0)		(2)					(9)
F7.3-1	SH. 13	(0)		(2)					(9)
F7.3-1	SH. 14	(0)		(2)					(9)
F7.3-1	SH. 15	(0)		(2)					(9)
F7.3-1	SH. 16	(0)	(1)						(9)
F7.3-2	SH. 1	(0)	(1)						
F7.3-2	SH. 2	(0)	(1)						
F7.3-2	SH. 3	(0)	(1)						
7.4-1		(0)	(1)					(6)	
7.4-1a								(6)	
7.4-2		(0)	(1)					(6)	
7.5-1		(0)	(1)					(6)	
7.5-2			(1)						
7.5-3			(1)					(6)	
7.5-4			(1)						
T7.5-1	SH. 1	(0)	(1)						
T7.5-1	SH. 2	(0)	(1)						
T7.5-1	SH. 3	(0)	(1-deleted)						
7.6-1		(0)						(6)	
7.6-1a								(6)	
7.6-1b								(6)	
7.6-2		(0)						(6)	
7.6-3		(0)	(1)					(6)	
7.6-3a								(6)	
7.6-4		(0)	(1)					(6)	
7.7-1		(0)	(1)		(3)				
7.7-1a			(1)	(2)	(3)				
7.7-1b			(1)	(2)	(3)	(4)			
7.7-1c				(2)	(3)	(4)		(6)	

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 3

7.7-1d					(3)	
7.7-2		(0)	(1)	(2)		(4)
7.7-3					(3)	
F7.7-1			(1)	(2)		
F7.7-2				(2)		
7.8-1		(0)	(1)	(2)		
7.8-2		(0)	(1)	(2)		
7.8-2a				(2)		
7.8-3			(1)	(2)		
7.8-3a				(2)		
7.8-4			(1)	(2)		
7.8-5			(1)	(2)		
7.8-5a				(2)		
7.8-6			(1)	(2)		
7.8-7			(1)	(2)	(3)	
7.8-8					(3)	
8-i		(0)	(1)			
8-ii		(0)	(1)			
8-iii		(0)	(1)			
8-iv		(0)	(1)			
8.1-1		(0)	(1)			
8.1-2		(0)				
8.1-3		(0)				
8.1-4		(0)				
8.1-5		(0)				
8.1-6		(0)				
8.1-7		(0)				
8.1-8		(0)				
8.1-9		(0)				
8.1-10		(0)				
8.1-11		(0)	(1)			
T8.1-1	SH. 1	(0)	(1)			
T8.1-1	SH. 2	(0)	(1)			
T8.1-1	SH. 3	(0)	(1-deleted)			
8.2-1		(0)				
8.3-1		(0)	(1)			
8.3-2		(0)				
8.3-3		(0)	(1)			
8.3-4		(0)				
8.3-5		(0)				
8.3-6		(0)				
8.3-7		(0)				
8.3-8		(0)				
8.3-9		(0)	(1)			
8.3-10		(0)	(1)			
8.3-11		(0)	(1)			
8.3-12		(0)				
8.3-13		(0)	(1)			
8.3-14		(0)	(1)			
8.3-15		(0)	(1)			
8.3-16		(0)				

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 3

8.3-17		(0)		
8.3-18		(0)		
8.3-19		(0)	(1)	(2)
8.3-20		(0)	(1)	
8.3-21		(0)	(1)	
8.3-22		(0)	(1)	
8.3-23		(0)	(1)	
8.3-24		(0)	(1)	
8.3-25		(0)	(1)	
8.3-26		(0)	(1)	
8.3-27		(0)	(1)	
8.3-28		(0)	(1)	
8.3-28a			(1)	
8.3-29		(0)		
8.3-30		(0)	(1)	
8.3-31		(0)	(1)	
8.3-31a			(1)	
8.3-32		(0)		
8.3-33		(0)		
8.3-34		(0)		
8.3-35		(0)	(1)	
8.3-36		(0)	(1)	
8.3-37		(0)	(1)	
8.3-38		(0)	(1)	
8.3-39		(0)		
8.3-40		(0)		
8.3-41		(0)		
8.3-42		(0)		
8.3-43		(0)		
8.3-44		(0)	(1)	
T8.3-1	SH. 1	(0)		
T8.3-1	SH. 2	(0)		
T8.3-1	SH. 3	(0)		
T8.3-1	SH. 4	(0)		
T8.3-1	SH. 5	(0)		
T8.3-1	SH. 6	(0)		
T8.3-1	SH. 7	(0)		
T8.3-1	SH. 8	(0)		
T8.3-1	SH. 9	(0)		
T8.3-2	SH. 1	(0)		
T8.3-2	SH. 2	(0)		
T8.3-2	SH. 3	(0)		
T8.3-2	SH. 4	(0)	(1)	
T8.3-2	SH. 5	(0)		
T8.3-2	SH. 6	(0)		
T8.3-2	SH. 7	(0)		
T8.3-2	SH. 8	(0)		
T8.3-3	SH. 1	(0)		
T8.3-3	SH. 2	(0)		
T8.3-3	SH. 3	(0)		
T8.3-3	SH. 4	(0)		

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 3

T8.3-3	SH. 5	(0)	
T8.3-3	SH. 6	(0)	
T8.3-3	SH. 7	(0)	
T8.3-3	SH. 8	(0)	
T8.3-3	SH. 9	(0)	
T8.3-3	SH. 10	(0)	
T8.3-3	SH. 11	(0)	
T8.3-3	SH. 12	(0,	
T8.3-3	SH. 13	(0)	
T8.3-3	SH. 14	(0)	
T8.3-3	SH. 15	(0)	
T8.3-3	SH. 16	(0)	
T8.3-3	SH. 17	(0)	
T8.3-3	SH. 18	(0)	
T8.3-3	SH. 19	(0) (1)	
T8.3-4		(0)	
T8.3-5		(0)	
T8.3-6	SH. 1	(0)	
T8.3-6	SH. 2	(0)	
T8.3-6	SH. 3	(0)	
T8.3-6	SH. 4	(0)	
T8.3-6	SH. 5	(0)	
T8.3-6	SH. 6	(0)	
T8.3-6	SH. 7	(0)	
T8.3-6	SH. 8	(0)	
T8.3-6	SH. 9	(0)	
T8.3-6	SH. 10	(0)	
T8.3-6	SH. 11	(0)	
T8.3-6	SH. 12	(0)	
T8.3-7	SH. 1	(0)	
T8.3-7	SH. 2	(0)	
T8.3-7	SH. 3	(0)	
T8.3-7	SH. 4	(0)	
F8.3-1		(0)	(2)
F8.3-2		(0)	
F8.3-3		(0)	
F8.3-4		(0)	
F8.3-5		(0)	
F8.3-6		(0)	
F8.3-7		(0)	
F8.3-8		(0)	
F8.3-9		(0)	
F8.3-10		(0)	
F8.3-11		(0)	
8.4-1		(0)	
T8.4-1	SH. 1	(0) (1)	
T8.4-1	SH. 2	(0) (1)	
T8.4-1	SH. 3	(0) (1)	
T8.4-1	SH. 4	(0) (1)	

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 3

(12 unnumbered contents pages Section 9)		(0)		(2-deleted)			
i				(2)			
ii				(2)			
iii				(2)			
iv				(2)			
v				(2)			
vi				(2)			
vii				(2)			
viii				(2)			
ix				(2)			
x				(2)			
xi				(2)			
xia				(2)			
xii				(2)			
9.1-1		(0)		(2)			
9.1-2		(0)		(2)			
9.1-2a				(2)			
9.1-3		(0)		(2)			(9)
9.1-4		(0)		(2)			
9.1-5		(0)		(2)			
9.1-5a				(2)			
9.1-6		(0)		(2)		(6)	
9.1-6a				(2)		(6)	
9.1-7		(0)	(1)				
9.1-7a			(1)				
9.1-8		(0)					
9.1-9		(0)	(1)				
9.1-10		(0)	(1)	(2)			
9.1-10a			(1)				
9.1-11		(0)	(1)	(2)			
9.1-12		(0)	(1)	(2)			
9.1-13		(0)	(1)	(2)			
9.1-14		(0)	(1)				
T9.1-1		(0)	(1)				
T9.1-2		(0)	(1)				
T9.1-3	SH. 1	(0)	(1)				
T9.1-3	SH. 2		(1)				
T9.1-4	SH. 1	(0)	(1)				
T9.1-4	SH. 2		(1)				
T9.1-4	SH. 3	(0)	(1)				
T9.1-4	SH. 4		(1)				
T9.1-5	SH. 1	(0)	(1)				
T9.1-5	SH. 2	(0)	(1)				
F9.1-1		(0)	(1)	(2)		(6-deleted)	
F9.1-2		(0)	(1)	(2)		(6-deleted)	
F9.1-3		(0)			(4)	(6)	
F9.1-3a	SH. 1					(6)	
F9.1-3a	SH. 2					(6)	
F9.1-3b	SH. 1					(6)	

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 3

F9.1-4		(0)					
F9.1-5				(2)		(6)	
9.2-1		(0)				(6)	(9)
9.2-1a						(6)	(9)
9.2-2		(0)					(9)
9.2-3		(0)					(9)
9.2-4		(0)	(1)				
9.2-5		(0)	(1)				(9)
9.2-6		(0)					(9)
9.2-7		(0)			(4)		(9)
9.2-8		(0)		(2)	(4)		(9)
9.2-8a							(9)
9.2-9		(0)					(9)
9.2-10		(0)			(4)		(9)
9.2-11		(0)				(6)	(9)
9.2-12		(0)	(1)			(6)	(9)
9.2-13		(0)	(1)			(6)	(9)
9.2-13a						(6)	(9)
9.2-14		(0)	(1)	(2)			
9.2-15		(0)	(1)				
9.2-16		(0)	(1)			(6)	(9)
9.2-17		(0)	(1)				(9)
9.2-18		(0)	(1)			(6)	(9)
9.2-18a						(6)	(9)
9.2-19		(0)					(9)
9.2-20		(0)					(9)
9.2-20a							(9)
9.2-21		(0)					(9)
9.2-22		(0)					(9)
9.2-23		(0)	(1)				(9)
9.2-24		(0)					(9)
9.2-25		(0)					(9)
9.2-26		(0)	(1)			(6)	(9)
9.2-26a						(6)	
9.2-27		(0)	(1)			(6)	(9)
T9.2-1	SH. 1	(0)	(1)				(9)
T9.2-1	SH. 2		(1)				(9)
T9.2-2	SH. 1	(0)	(1)				(9)
T9.2-2	SH. 2		(1)				(9)
T9.2-3		(0)	(1)				(9)
T9.2-4		(0)					
T9.2-5	SH. 1	(0)	(1)			(6)	
T9.2-5	SH. 2	(0)	(1)			(6)	
T9.2-6	SH. 1	(0)	(1)		(4)		(9)
T9.2-6	SH. 2	(0)	(1)	(2)	(4)		(9)
T9.2-6	SH. 3	(0)	(1)	(2)	(4)		(9)
T9.2-6	SH. 4		(1)		(4)		(9)
T9.2-6	SH. 5		(1)	(2)	(4)		(9)
T9.2-6	SH. 6		(1)	(2)	(4)		(9)
T9.2-6	SH. 6a						(9)
T9.2-7	SH. 1	(0)	(1)		(4)		(9)

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 3

T9.2-7	SH. 2	(0)	(1)	(2)	(4)		(9)
T9.2-7	SH. 3	(0)	(1)	(2)	(4)		(9)
T9.2-7	SH. 4		(1)		(4)		(9)
T9.2-7	SH. 5		(1)	(2)	(4)		(9)
T9.2-7	SH. 6		(1)	(2)	(4)		(9)
T9.2-7	SH. 6a						(9)
T9.2-8	SH. 1	(0)	(1)				(9)
T9.2-8	SH. 2	(0)	(1)				(9)
T9.2-8	SH. 3	(0)	(1)				(9)
T9.2-9	SH. 1	(0)					
T9.2-9	SH. 2	(0)					
T9.2-10		(0)	(1)			(6)	
T9.2-11		(0)					
T9.2-12		(0)	(1)				
T9.2-13		(0)				(6-deleted)	
T9.2-14				(2)			
F9.2-1		(0)				(6)	(9)
F9.2-1a	SH. 1					(6)	
F9.2-2b	SH. 1					(6)	
F9.2-2		(0)				(6)	(9)
F9.2-3		(0)		(2)	(4)	(6)	
F9.2-4		(0)		(2)	(4)	(6)	
F9.2-4a	SH. 1					(6)	
F9.2-4a	SH. 2					(6)	
F9.2-4a	SH. 3					(6)	
F9.2-4b	SH. 1					(6)	
F9.2-4b	SH. 2					(6)	
F9.2-5		(0)		(2)			(9)
F9.2-6		(0)		(2)			(9)
F9.2-7		(0)	(1)			(6)	
9.3-1		(0)	(1)		(4)		
9.3-2		(0)	(1)				
9.3-3		(0)			(4)		
9.3-4		(0)		(2)	(4)		
9.3-4a				(2)	(4)		
9.3-4b				(2)			
9.3-5		(0)	(1)	(2)	(4)		
9.3-5A				(2)			
9.3-6		(0)					
9.3-7		(0)	(1)				
9.3-8		(0)		(2)			
9.3-8a				(2)			
9.3-9		(0)		(2)			
9.3-9a				(2)			
9.3-9b				(2)			
9.3-10		(0)		(2)		(6)	
9.3-10a						(6)	
9.3-11		(0)	(1)	(2)		(6)	
9.3-12		(0)	(1)				
9.3-13		(0)	(1)			(6)	
T9.3-1		(0)		(2)			

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 3

T9.3-2		(0)		(2)				
T9.3-2	(cont.)	(0)		(2-deleted)				
T9.3-2	(cont.)	(0)		(2-deleted)				
T9.3-2	SH. 1	(0)		(2-deleted)				
T9.3-2	SH. 2	(0)		(2-deleted)				
T9.3-2	SH. 3	(0)		(2-deleted)				
T9.3-2	SH. 4	(0)		(2-deleted)				
T9.3-3				(2)				
T9.3-4	SH. 1			(2)				
T9.3-4	SH. 2			(2)				
T9.3-4	SH. 3			(2)				
T9.3-4	SH. 4			(2)				
T9.3-6							(6)	
F9.3-1		(0)		(2)				
F9.3-2				(2)			(6)	
F9.3-2a	SH. 1						(6)	
F9.3-2b	SH. 1						(6)	
F9.3-3	SH. 1						(6)	
F9.3-3	SH. 2						(6)	
F9.3-4							(6)	
9.4-1		(0)	(1)				(6)	(8)
9.4-1a							(6)	(8-deleted)
9.4-2		(0)	(1)	(2)		(5)	(6)	(8)
9.4-3		(0)	(1)				(6)	(8)
9.4-3a								(8)
9.4-4		(0)		(2)			(6)	(8)
9.4-5		(0)	(1)	(2)				(8)
9.4-6		(0)	(1)	(2)				(8)
9.4-6a				(2)				(8)
9.4-6b								(8)
9.4-7		(0)	(1)	(2)	(3)	(5)		(8)
9.4-7a			(1)					(8)
9.4-8		(0)	(1)		(3)	(5)	(6)	(8)
9.4-9		(0)	(1)	(2)			(6)	
9.4-9a				(2)			(6)	
9.4-10		(0)	(1)	(2)	(3)	(5)	(6)	
9.4-10a				(2)	(3)			
9.4-11		(0)	(1)	(2)		(5)	(6)	
9.4-11a							(6)	
9.4-12		(0)	(1)					
9.4-13		(0)					(6)	
9.4-14		(0)	(1)	(2)		(5)	(6)	
9.4-14a							(6)	
9.4-15		(0)	(1)		(3)	(5)	(6)	
9.4-16		(0)	(1)	(2)	(3)	(5)	(6)	
9.4-16a				(2)				
9.4-17		(0)	(1)	(2)			(6)	
9.4-18		(0)	(1)	(2)				
9.4-19		(0)	(1)	(2)		(5)	(6)	
9.4-20		(0)	(1)	(2)				
9.4-20a				(2)	(3)			

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 3

9.4-21		(0)	(1)		(3)	(5)	(6)		
9.4-22		(0)	(1)		(3)	(5)	(6)		
9.4-23		(0)	(1)		(3)				
9.4-23a			(1)		(3)				
9.4-24		(0)	(1)	(2)	(3)	(5)			
9.4-24a				(2)		(5)			
9.4-25		(0)		(2)	(3)				
9.4-25a				(2)					
9.4-26		(0)	(1)		(3)	(5)	(6)		
9.4-27		(0)	(1)	(2)	(3)				
9.4-27a					(3)				
9.4-28		(0)	(1)		(3)		(6)		
9.4-28a							(6)		
9.4-29		(0)	(1)						
9.4-30		(0)	(1)	(2)			(6)		
9.4-31		(0)	(1)	(2)			(6)		
9.4-31a				(2)			(6)		
9.4-32		(0)	(1)	(2)			(6)		
9.4-33		(0)		(2)	(3)		(6)		
9.4-34		(0)					(6)		
9.4-34a				(2)			(6)		
9.4-35			(1)	(2)			(6)		
T9.4-1		(0)	(1)				(6)		
T9.4-2		(0)	(1)				(6)		
T9.4-3		(0)	(1)	(2)				(8)	
T9.4-4	SH. 1	(0)	(1)	(2)	(3)				
T9.4-4	SH. 2	(0)	(1)	(2)	(3)				
T9.4-5	SH. 1	(0)	(1)		(3)				
T9.4-5	SH. 2	(0)							
T9.4-6	SH. 1	(0)	(1)	(2)			(6)		
T9.4-6	SH. 2	(0)	(1)	(2)			(6)		
T9.4-6	SH. 2a			(2)			(6-deleted)		
T9.4-6	SH. 3	(0)	(1)	(2)			(6-deleted)		
T9.4-7		(0)	(1)				(6)		
T9.4-8	SH. 1	(0)			(3)	(5)			
T9.4-8	SH. 2	(0)			(3)	(5)			
T9.4-8	SH. 3	(0)		(2)					
T9.4-9	SH. 1	(0)	(1)	(2)	(3)	(5)			
T9.4-9	SH. 2	(0)	(1)	(2)	(3)	(5)			
9.4-10							(6)		
9.4-11							(6)		
9.4-12							(6)		
F9.4-1		(0)		(2)			(6)	(8)	
F9.4-2		(0)	(1-deleted)			(5)	(6)		
F9.4-3		(0)	(1-deleted)				(6)		
F9.4-4		(0)	(1-deleted)						
F9.4-5		(0)					(6)		(9)
F9.4-6		(0)			(3)	(5)	(6)		(9)
F9.4-7		(0)				(5)			
F9.4-8		(0)		(2)					
F9.4-9		(0)			(3)	(5)			

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 3

F9.4-10	(0)		(2)		(5)			
F9.4-11	(0)		(2)					
F9.4-12	(0)			(3)	(5)			
F9.4-13	(0)		(2)					
F9.4-14	(0)		(2)		(5)	(6)		
F9.4-15	(0)		(2)					
F9.4-16	(0)		(2)				(8)	
F9.4-17	(0)		(2)					
F9.4-18			(2)					
9.5-1	(0)	(1)					(8)	
9.5-2	(0)						(8)	
9.5-3	(0)						(8)	
9.5-4	(0)	(1)					(8)	
9.5-5	(0)	(1)					(8)	
9.5-6	(0)						(8)	
9.5-7	(0)						(8)	
9.5-8	(0)						(8)	
9.5-9	(0)						(8)	
9.5-10	(0)	(1)					(8)	
9.5-11	(0)						(8)	
9.5-12	(0)						(8)	
9.5-13	(0)						(8)	
9.5-14	(0)	(1)					(8)	
9.5-15	(0)	(1)					(8)	
9.5-16	(0)	(1)					(8)	
9.5-17	(0)						(8)	
9.5-18	(0)						(8)	
9.5-19	(0)	(1)					(8)	
9.5-20	(0)	(1)					(8)	
9.5-21	(0)	(1)					(8)	
9.5-22	(0)	(1)					(8)	
9.5-23	(0)	(1)					(8)	
9.5-23a							(8)	
9.5-23b							(8)	
9.5-23c							(8)	
9.5-23d							(8)	
9.5-23e							(8)	
9.5-23f							(8)	
9.5-23g							(8)	
9.5-23h							(8)	
9.5-23i							(8)	
9.5-23j							(8)	
9.5-23k							(8)	
9.5-23l							(8)	
9.5-24	(0)							(9)
9.5-24a								(9)
9.5-25	(0)	(1)						(9)
9.5-25a								(9)
9.5-25c								(9)
9.5-25d								(9)
9.5-26	(0)	(1)						(9)

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 3

9.5-27		(0)	(1)						(9)
9.5-27a									(9)
9.5-28		(0)							
9.5-29		(0)	(1)			(6)			
9.5-29a						(6)			
9.5-30		(0)	(1)			(6)			
9.5-30a						(6)			
9.5-31		(0)				(6)			(9)
9.5-32		(0)	(1)			(6)			(9)
9.5-32a						(6)			(9)
9.5-33			(1)						
9.5-34					(3)		(7)		
9.5-34a							(7)		
9.5-35					(3)	(6)			
9.5-35a						(6)			
9.5-36					(3)				
T9.5-1	SH. 1	(0)	(1)						
T9.5-1	SH. 2	(0)	(1)						
T9.5-1	SH. 3	(0)							
T9.5-2		(0)							
T9.5-3	SH. 1	(0)	(1)	(2)					
T9.5-3	SH. 2	(0)	(1)						
T9.5-4		(0)	(1)						
T9.5-5		(0)	(1)						
T9.5-6					(3)				
T9.5-7	SH. 1							(8)	
T9.5-7	SH. 2							(8)	
T9.5-8								(8)	
F9.5-1		(0)						(8 deleted)	
F9.5-1A								(8)	
F9.5-1B								(8)	
F9.5-2		(0)							
F9.5-3		(0)							
F9.5-4		(0)				(6)			
F9.5-5		(0)				(6)			
F9.5-6					(3)	(6)			
F9.5-7					(3)				

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 4

10-i		(0)	(1)	(2)			
10-ii		(0)					
10-iii		(0)					
10-iv		(0)					
10-v		(0)					
10-vi		(0)	(1)				
10-vii		(0)					
10.1-1		(0)	(1)			(6)	
10.1-2		(0)	(1)				
T10.1-1		(0)	(1)	(2)		(6)	
T10.1-2	Sh. 1	(0)	(1)	(2)		(6)	
T10.1-2	Sh. 2	(0)	(1)	(2)		(6)	
F10.1-1		(0)					
F10.1-2		(0)					
F10.1-3		(0)					
F10.1-4		(0)					
F10.1-5		(0)					
F10.1-6		(0)					
10.2-1		(0)	(1)				
10.2-2		(0)	(1)				
10.2-3		(0)	(1)				
10.2-4		(0)	(1)				
10.2-5		(0)	(1)				
10.2-6		(0)	(1)				
10.2-7		(0)	(1)				
10.2-8		(0)	(1)				
10.2-9		(0)	(1)				
10.2-10		(0)	(1)				
10.2-11		(0)	(1)				
10.2-12		(0)	(1)		(5)		
10.2-13		(0)	(1)		(5)		
10.2-14		(0)	(1)	(2)	(5)		
10.2-14a				(2)	(5)		
10.2-14b				(2)	(5)		
10.2-14c					(5)		
10.2-15		(0)	(1)	(2)	(5)		
10.2-15a				(2)	(5)		
10.2-16		(0)	(1)		(5)		
10.2-17		(0)	(1)		(5)		
10.2-18		(0)	(1)		(5)		
10.2-18a					(5)		
10.2-19		(0)	(1)				
10.3-1		(0)	(1)			(6)	
10.3-1a						(6)	
10.3-2		(0)	(1)			(6)	
10.3-3		(0)	(1)			(6)	
10.3-3a						(6)	
10.3-4		(0)	(1)			(6)	(7)
10.3-5		(0)	(1)				(7)

10.3-5a								(7)	
10.3-6		(0)	(1)				(6)		
10.3-7		(0)	(1)						
10.3-8		(0)	(1)				(6)		
10.3-8a							(6)		
10.3-9		(0)	(1)		(4)	(5)			
10.3-10		(0)	(1)		(4)	(5)			
T10.3-1			(1)						
T10.3-2									(9)
F10.3-1		(0)		(2)			(6)		
F10.3-1a	Sh. 1						(6)		
F10.3-1a	Sh. 2						(6)		
F10.3-1b	Sh. 1						(6)		
F10.3-1b	Sh. 2						(6)		
F10.3-2		(0)					(6)		
F10.3-2a	Sh. 1						(6)		
F10.3-2b	Sh. 1						(6)		
10.4-1		(0)							
10.4-2		(0)							
10.4-3		(0)							
10.4-4		(0)							
10.4-5		(0)							
10.4-6		(0)			(4)		(6)		
10.4-7		(0)					(6)		
10.4-8		(0)					(6)		
10.4-8a							(6)		
10.4-9		(0)							
10.4-10		(0)					(6)		
10.4-10a							(6)		
10.4-11		(0)					(6)		
10.4-12		(0)					(6)		
10.4-13		(0)	(1)						
10.4-14		(0)	(1)				(6)		
10.4-14a			(1)						
10.4-15		(0)					(6)		
10.4-15a							(6)		
10.4-16		(0)	(1)						
10.4-17		(0)					(6)		
10.4-17a							(6)		
10.4-18		(0)							
10.4-19		(0)	(1)						
10.4-20		(0)	(1)						
10.4-21		(0)	(1)						
10.4-22		(0)							
10.4-23		(0)							
10.4-24		(0)							
10.4-25		(0)							
10.4-26		(0)	(1)						
10.4-27		(0)					(6)		

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 4

10.4-27a						(6)	
10.4-28		(0)	(1)			(6)	(9)
10.4-28a						(6)	
10.4-29		(0)	(1)				
10.4-30		(0)	(1)			(6)	
10.4-31		(0)	(1)			(6)	
10.4-31a						(6)	
10.4-32		(0)	(1)			(6)	
10.4-32a			(1)			(6)	
10.4-33		(0)	(1)			(6)	
10.4-34					(3)		
10.4-35					(3)		
T10.4-1	Sh. 1	(0)					
T10.4-1	Sh. 2	(0)					
T10.4-1	Sh. 3	(0)					
T10.4-2	Sh. 1	(0)	(1)				
T10.4-2	Sh. 2	(0)	(1)				
T10.4-2	Sh. 3	(0)	(1)				
T10.4-3			(1)				
T10.4-4	Sh. 1					(6)	(9)
T10.4-4	Sh. 2					(6)	(9)
T10.4-5						(6)	
F10.4-1		(0)		(2)			
F10.4-2	Sh. 1	(0)		(2)		(6)	
F10.4-2	Sh. 2	(0)					
F10.4-3		(0)				(6)	
F10.4-3a	Sh. 1					(6)	
F10.4-3a	Sh. 2					(6)	
F10.4-3b	Sh. 1					(6)	
F10.4-4		(0)					
F10.4-5						(6)	
F10.4-6						(6)	
11-i				(2)			
11-ii				(2)			
11-iii				(2)			
11-iv				(2)			
11-v				(2)			
11-vi				(2)			
11-vii				(2)			
11-viii				(2)			
11-ix				(2)			
11-x				(2)			
11-xi				(2)			
11.1-1		(0)		(2)			
11.1-2		(0)		(2)			
11.1-3		(0)		(2-deleted)			
11.1-4		(0)		(2-deleted)			
11.1-5		(0)		(2-deleted)			
T11.1-1	Sh. 1	(0)		(2)			

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 4

T11.1-1	Sh. 2	(0)	(2-deleted)		
T11.1-1	Sh. 3	(0)	(2-deleted)		
T11.1-2	Sh. 1	(0)	(2)		
T11.1-2	Sh. 2	(0)	(2)		
T11.1-3		(0)	(2)		
T11.1-4		(0)	(2-deleted)		
11.2-1		(0)	(2)	(6)	
11.2-1a			(2)	(6)	
11.2-2		(0)	(2)		
11.2-3		(0)	(2)		
11.2-3a			(2)		
11.2-4		(0)	(2)		
11.2-4a			(2)		
11.2-5		(0)	(2)		
11.2-6		(0)	(2)		
11.2-7		(0)	(2)		
11.2-8		(0)	(2)		
11.2-9		(0)	(2)		
11.2-10		(0)	(2)		
11.2-10a			(2)		
11.2-11		(0)	(2)	(6)	
11.2-11a			(2)		
11.2-12		(0)	(2)		
11.2-13			(2)		
T11.2-1	Sh. 1	(0)	(2)	(6)	(8)
T11.2-1	Sh. 2	(0)	(2)	(6)	
T11.2-2		(0)	(2)		
T11.2-3	Sh. 1	(0)	(2)		
T11.2-3	Sh. 2		(2)		
T11.2-4	Sh. 1	(0)	(2)		
T11.2-4	Sh. 1a		(2)		
T11.2-4	Sh. 2	(0)	(2)		
T11.2-4	Sh. 2a		(2)		
T11.2-4	Sh. 3	(0)	(2)		
T11.2-4	Sh. 4	(0)	(2)		
T11.2-4	Sh. 5	(0)	(2)		
T11.2-4	Sh. 6	(0)	(2)		(8)
T11.2-4	Sh. 6a		(2)		
T11.2-4	Sh. 7	(0)	(2)		
T11.2-4	Sh. 8	(0)	(2)		
T11.2-5	Sh. 1	(0)	(2)	(6)	
T11.2-5	Sh. 2	(0)	(2)		
T11.2-5	Sh. 3	(0)	(2)	(6)	
T11.2-5	Sh. 4	(0)	(2-deleted)		
T11.2-5	Sh. 5	(0)	(2-deleted)		
T11.2-5	Sh. 6	(0)	(2)		
T11.2-5	Sh. 7	(0)	(2)	(6)	
T11.2-5	Sh. 8	(0)	(2)		
T11.2-5	Sh. 9	(0)	(2)	(6)	

T11.2-5	Sh. 10	(0)	(2)	
T11.2-5	Sh. 11	(0)	(2)	
T11.2-5	Sh. 12	(0)	(2)	
T11.2-5	Sh. 12a		(2)	(6)
T11.2-5	Sh. 13	(0)	(2)	
T11.2-5	Sh. 14	(0)	(2)	(6)
T11.2-5	Sh. 15	(0)	(2)	
T11.2-5	Sh. 16	(0)	(2)	(6)
T11.2-5	Sh. 17	(0)	(2)	
T11.2-5	Sh. 18	(0)	(2-deleted)	
T11.2-5	Sh. 19	(0)	(2)	
T11.2-5	Sh. 20	(0)	(2)	(6)
T11.2-5	Sh. 21	(0)	(2-deleted)	
T11.2-5	Sh. 22	(0)	(2-deleted)	
T11.2-5	Sh. 23	(0)	(2)	
T11.2-5	Sh. 24	(0)	(2)	(6)
T11.2-5	Sh. 25	(0)	(2-deleted)	
T11.2-5	Sh. 26	(0)	(2)	(6)
T11.2-5	Sh. 27	(0)	(2)	
T11.2-5	Sh. 28	(0)	(2)	(6)
T11.2-5	Sh. 29	(0)	(2)	
T11.2-6	Sh. 1	(0)	(2)	
T11.2-6	Sh. 2		(2)	
T11.2-7		(0)	(2)	(6)
T11.2-8		(0)	(2)	
T11.2-9		(0)	(2)	
T11.2-10			(2)	(6)
T11.2-11				(6)
T11.2-12				(6)
T11.2-13				(6)
T11.2-14				(6)
T11.2-15				(6)
T11.2-16				(6)
T11.2-17				(6)
T11.2-18				(6)
T11.2-19				(6)
T11.2-20				(6)
T11.2-21				(6)
T11.2-22				(6)
T11.2-23				(6)
F11.2-1		(0)	(2-deleted)	
F11.2-2	Sh. 1	(0)	(2)	(6-deleted)
F11.2-2	Sh. 2	(0)	(2-deleted)	
F11.2-3		(0)	(2)	(6-deleted)
F11.2-4		(0)	(2)	(6-deleted)
F11.2-5		(0)	(2)	(6-deleted)
F11.2-6		(0)	(2)	(6-deleted)
F11.2-7		(0)	(2)	(6-deleted)
F11.2-8		(0)	(2)	(6-deleted)

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 4

F11.2-9		(0)	(2-deleted)	
F11.2-10		(0)	(2)	(6-deleted)
F11.2-11		(0)	(2)	(6-deleted)
F11.2-12		(0)	(2)	(6-deleted)
F11.2-13		(0)	(2)	(6-deleted)
F11.2-14		(0)	(2)	(6-deleted)
F11.2-15		(0)	(2)	(6-deleted)
F11.2-16		(0)	(2)	(6-deleted)
F11.2-17		(0)	(2-deleted)	
F11.2-18		(0)	(2)	(6-deleted)
F11.2-19		(0)	(2)	(6-deleted)
F11.2-20		(0)	(2)	(6-deleted)
F11.2-21		(0)	(2)	(6-deleted)
F11.2-22		(0)	(2)	(6-deleted)
F11.2-23		(0)	(2)	(6-deleted)
F11.2-24		(0)	(2)	(6-deleted)
F11.2-25		(0)	(2)	(6-deleted)
F11.2-26		(0)	(2)	(6-deleted)
F11.2-27		(0)	(2-deleted)	
F11.2-28		(0)	(2-deleted)	
F11.2-29		(0)	(2-deleted)	
F11.2-30		(0)	(2-deleted)	
F11.2-31		(0)	(2-deleted)	
F11.2-22	Sh. 1	(0)	(2-deleted)	
F11.2-23	Sh. 2	(0)	(2-deleted)	
F11.2-24	Sh. 3	(0)	(2-deleted)	
F11.2-25	Sh. 4	(0)	(2-deleted)	
F11.2-26	Sh. 5	(0)	(2-deleted)	
F11.2-32			(2)	(6)
F11.2-33			(2)	(6)
F11.2-34			(2)	(6)
11.3-1		(0)	(2)	(6)
11.3-1a			(2)	
11.3-2		(0)	(2)	
11.3-3		(0)	(2)	
11.3-4		(0)	(2)	
11.3-5		(0)	(2)	
11.3-6		(0)	(2)	(6)
11.3-7		(0)	(2)	
11.3-8		(0)	(2)	
11.3-9		(0)	(2)	
11.3-9a			(2)	
11.3-10		(0)	(2)	
11.3-11		(0)	(2)	
11.3-12		(0)	(2)	
11.3-12a			(2)	
11.3-13		(0)	(2)	
11.3-14		(0)	(2)	
11.3-14a			(2)	

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 4

11.3-15		(0)	(2)		
11.3-16		(0)	(2)		
11.3-16a			(2)		
11.3-17		(0)	(2)		
11.3-18		(0)	(2)		
11.3-18a			(2)		
11.3-19		(0)	(2)		
T11.3-1	Sh. 1	(0)	(2)	(4)	
T11.3-1	Sh. 2	(0)	(2)	(4)	
T11.3-2		(0)	(2)	(4)	
T11.3-3	Sh. 1	(0)	(2)		
T11.3-3	Sh. 2	(0)	(2)		
T11.3-3	Sh. 3	(0)	(2)		
T11.3-4	Sh. 1	(0)	(2)		
T11.3-4	Sh. 2	(0)	(2)		(6)
T11.3-4	Sh. 3	(0)	(2)		
T11.3-4	Sh. 4	(0)	(2)		
T11.3-5	Sh. 1	(0)	(2)		
T11.3-5	Sh. 2	(0)	(2-deleted)		
T11.3-6	Sh. 1	(0)	(2)		
T11.3-6	Sh. 2	(0)	(2-deleted)		
T11.3-7	Sh. 1	(0)	(2)		
T11.3-7	Sh. 2	(0)	(2)		
T11.3-7	Sh. 3	(0)	(2)		
T11.3-8		(0)	(2-deleted)		
T11.3-9		(0)	(2)		
T11.3-10		(0)	(2)		
T11.3-11			(2)	(4)	
T11.3-12			(2)	(4)	
T11.3-13	Sh. 1		(2)	(4)	
T11.3-13	Sh. 2		(2)	(4)	
T11.3-14	Sh. 1		(2)	(4)	
T11.3-14	Sh. 2		(2)	(4)	
T11.3-15	Sh. 1		(2)	(4)	
T11.3-15	Sh. 2		(2)	(4)	
T11.3-16	Sh. 1		(2)	(4)	
T11.3-16	Sh. 2		(2)	(4)	
T11.3-17	Sh. 1		(2)	(4)	
T11.3-17	Sh. 2		(2)	(4)	
T11.3-18	Sh. 1		(2)	(4)	
T11.3-18	Sh. 2		(2)	(4)	
T11.3-19	Sh. 1		(2)	(4)	
T11.3-19	Sh. 2		(2)	(4)	
T11.3-20			(2)		
F11.3-1		(0)			
F11.3-2		(0)	(2)		
F11.3-3		(0)	(2)		
F11.3-4		(0)	(2)		
F11.3-5		(0)	(2)		

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 4

F11.3-6	Sh. 1	(0)	(2)	
F11.3-6	Sh. 2	(0)	(2-deleted)	
F11.3-7	Sh. 1	(0)	(2)	
F11.3-7	Sh. 2	(0)	(2-deleted)	
F11.3-8	Sh. 1	(0)	(2)	
F11.3-8	Sh. 2	(0)	(2-deleted)	
F11.3-9	Sh. 1	(0)	(2)	
F11.3-9	Sh. 2	(0)	(2-deleted)	
F11.3-10		(0)	(2)	
F11.3-11		(0)	(2)	
F11.3-12		(0)	(2)	
F11.3-13		(0)	(2)	
F11.3-14		(0)	(2)	
F11.3-15		(0)	(2)	
F11.3-16		(0)	(2)	
F11.3-17		(0)	(2-deleted)	
F11.3-18	Sh. 1	(0)	(2)	
F11.3-18	Sh. 2	(0)	(2-deleted)	
F11.3-19	Sh. 1	(0)	(2)	
F11.3-19	Sh. 2	(0)	(2-deleted)	
F11.3-20	Sh. 1	(0)	(2)	
F11.3-20	Sh. 2	(0)	(2-deleted)	
F11.3-21	Sh. 1	(0)	(2-deleted)	
F11.3-21	Sh. 2	(0)	(2-deleted)	
F11.3-22		(0)	(2)	
F11.3-23		(0)	(2)	
F11.3-24	Sh. 1	(0)	(2)	(6)
F11.3-24	Sh. 2	(0)	(2)	(6)
11.4-1		(0)	(2)	
11.4-1a			(2)	
11.4-2		(0)	(2)	
11.4-2a			(2)	
11.4-3		(0)		
11.4-4		(0)	(2)	
11.4-4a			(2)	
11.4-5		(0)	(2-deleted)	
11.4-6		(0)	(2-deleted)	
11.4-7		(0)		
11.4-8		(0)		
11.4-9		(0)		
11.4-10		(0)		
11.4-10a			(2)	
11.4-11		(0)	(2)	
11.4-12		(0)	(2)	
T11.4-1		(0)	(2)	
T11.4-2	Sh. 1	(0)	(2)	
T11.4-2	Sh. 2		(2)	
T11.4-2	Sh. 3		(2)	
T11.4-2	Sh. 4		(2)	

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 4

T11.4-2	Sh. 5		(2)			
T11.4-2	Sh. 6		(2)			
T11.4-2	Sh. 7		(2)			
T11.4-2	Sh. 8		(2)			
T11.4-2	Sh. 9		(2)			
T11.4-2	Sh. 10		(2)			
T11.4-2	Sh. 11		(2)			
T11.4-2	Sh. 12		(2)			
T11.4-2	Sh. 13		(2)			
T11.4-2	Sh. 14		(2)			
T11.4-3	Sh. 1	(0)	(2)			
T11.4-3	Sh. 2	(0)	(2-deleted)			
T11.4-4		(0)	(2)			
T11.4-5	Sh. 1		(2)			
T11.4-5	Sh. 2		(2)			
T11.4-5	Sh. 3		(2)			
T11.4-5	Sh. 4		(2)			
T11.4-5	Sh. 5		(2)			
T11.4-5	Sh. 6		(2)			
T11.4-5	Sh. 7		(2)			
T11.4-5	Sh. 8		(2)			
T11.4-5	Sh. 9		(2)			
T11.4-5	Sh. 10		(2)			
F11.4-1		(0)	(2)	(6)		
F11.4-2			(2)			(2)
11.5-1		(0)	(2)			
11.5-1a			(2)			
11.5-2		(0)				
11.5-3		(0)	(2)			(9)
11.5-3a						(9)
11.5-4		(0)	(2)			
11.5-5		(0)	(2)			(9)
11.5-5a						(9)
11.5-6		(0)				
11.5-7		(0)				
11.5-8		(0)				
11.5-9		(0)	(2)			
11.5-10		(0)	(2)			
T11.5-1	Sh. 1	(0)			(8)	
T11.5-1	Sh. 2				(8)	
T11.5-2	Sh. 1	(0)				
T11.5-2	Sh. 2	(0)				
T11.5-2	Sh. 3	(0)				
T11.5-3		(0)				
T11.5-4		(0)				
11A-1			(2)	(6)		
11A-2				(6)		
11A-3				(6)		
11A-4				(6)		

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 4

11A-5				(6)
11A-6				(6)
T11A-1				(6)
T11A-2	Sh. 1			(6)
T11A-2	Sh. 2			(6)
T11A-3				(6)
T11A-4				(6)
T11A-5				(6)
T11A-6				(6)
T11A-7				(6)
T11A-8	Sh. 1			(6)
T11A-8	Sh. 2			(6)
T11A-9				(6)
T11A-10				(6)
T11A-11				(6)
T11A-12				(6)
T11A-13				(6)
T11A-14				(6)
T11A-15				(6)
T11A-16				(6)
T11A-17				(6)
T11A-18				(6)
T11A-19				(6)
T11A-20				(6)
T11A-21				(6)
T11A-22				(6)
T11A-23				(6)
T11A-24				(6)
T11A-25				(6)
T11A-26				(6)
T11A-27				(6)
T11A-28				(6)
T11A-29				(6)
T11A-30				(6)
T11A-31				(6)
T11A-32				(6)
T11A-33				(6)
T11A-34				(6)
T11A-35				(6)
T11A-36				(6)
T11A-37				(6)
T11A-38				(6)
T11A-39				(6)
T11A-40				(6)
T11A-41				(6)
11B-1		(2)		(6)
T11B-1	Sh. 1	(2)	(4)	(6)
T11B-1	Sh. 2	(2)	(4)	(6)
T11B-1	Sh. 3	(2)	(4)	(6)

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 4

T11B-1	Sh. 4			(2)	(4)	(6)	
T11B-1	Sh. 5			(2)	(4)	(6)	
T11B-1	Sh. 6			(2)	(4)	(6)	
T11B-2				(2)		(6)	
T11B-3	Sh. 1			(2)			
T11B-3	Sh. 2			(2)			
12-i		(0)	(1)				
12-ii		(0)	(1)				
12-iii		(0)	(1)				
12-iv		(0)	(1)				
12-v		(0)	(1)				
12-vi		(0)	(1)				
12.1-1		(0)	(1)				
12.1-2		(0)	(1)				
12.1-3		(0)	(1)				
12.1-4		(0)	(1)				
12.1-5		(0)					
12.2-1		(0)	(1)				
12.2-2		(0)					
12.2-3		(0)	(1)				
12.2-4		(0)					
12.2-5		(0)					
12.2-6		(0)				(6)	
12.2-7		(0)	(1)				
12.2-8		(0)	(1)				(7)
12.2-9		(0)				(6)	
12.3-9a						(6)	
12.2-10		(0)					
12.2-11		(0)	(1)				
12.2-12		(0)					
12.2-13		(0)	(1)				
12.2-14		(0)	(1)				
12.2-15		(0)	(1)				
T12.2-1		(0)	(1)				
T12.2-2		(0)	(1)				
T12.2-3		(0)	(1)				
T12.2-4		(0)					
T12.2-5	Sh. 1	(0)	(1)				
T12.2-5	Sh. 2	(0)	(1-deleted)				
T12.2-5	Sh. 3	(0)	(1-deleted)				
T12.2-5	Sh. 4	(0)	(1-deleted)				
T12.2-5	Sh. 5	(0)	(1-deleted)				
T12.2-5	Sh. 6	(0)	(1-deleted)				
T12.2-5	Sh. 7	(0)	(1-deleted)				
T12.2-5	Sh. 8	(0)	(1-deleted)				
T12.2-6	Sh. 1	(0)	(1)				
T12.2-6	Sh. 2	(0)	(1-deleted)				
T12.2-6	Sh. 3	(0)	(1-deleted)				
T12.2-6	Sh. 4	(0)	(1-deleted)				

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 4

T12.2-6	Sh. 5	(0) (1-deleted)
T12.2-7		(0) (1)
T12.2-8		(0)
T12.2-9		(0)
T12.2-10	Sh. 1	(0) (1)
T12.2-10	Sh. 2	(0)
T12.2-10	Sh. 3	(0)
T12.2-11		(0)
T12.2-12		(0) (1)
T12.2-13	Sh. 1	(0)
T12.2-13	Sh. 2	(0)
T12.2-13	Sh. 3	(0)
T12.2-13	Sh. 4	(0)
T12.2-14	Sh. 1	(0)
T12.2-14	Sh. 2	(0)
T12.2-14	Sh. 3	(0)
T12.2-15	Sh. 1	(0)
T12.2-15	Sh. 2	(0)
T12.2-16	Sh. 1	(0) (1)
T12.2-16	Sh. 2	(0) (1)
T12.2-16	Sh. 3	(0) (1)
T12.2-16	Sh. 4	(0) (1)
T12.2-16	Sh. 5	(0) (1)
T12.2-16	Sh. 6	(0) (1)
T12.2-16	Sh. 7	(0) (1)
T12.2-16	Sh. 8	(0) (1)
T12.2-16	Sh. 9	(0) (1)
T12.2-16	Sh. 10	(0) (1)
T12.2-16	Sh. 11	(0) (1)
T12.2-16	Sh. 12	(0) (1)
T12.2-16	Sh. 13	(0) (1)
T12.2-16	Sh. 14	(0) (1)
T12.2-17	Sh. 1	(0) (1)
T12.2-17	Sh. 2	(0) (1)
12.3-1		(0)
12.3-2		(0) (1)
12.3-3		(0) (1)
12.3-4		(0) (1)
12.3-5		(0)
12.3-6		(0) (1)
12.3-7		(0) (1)
12.3-8		(0)
12.3-9		(0)
12.3-10		(0) (1)
12.3-11		(0) (1)
12.3-12		(0)
12.3-13		(0) (1)
12.3-14		(0)
12.3-15		(0) (1)

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 4

12.3-16		(0)					
12.3-17		(0)					
12.3-18		(0)	(1)				(9)
12.3.18a							(9)
12.3-19		(0)					
12.3-20		(0)		(2)			
12.3-21				(2)			
T12.3-1		(0)					
T12.3-2		(0)					
T12.3-3	Sh. 1	(0)	(1)				(8)
T12.3-3	Sh. 2	(0)	(1)				(8 deleted)
T12.3-4	Sh. 1						(8)
T12.3-4	Sh. 2						(8)
T12.3-4	Sh. 3						(8)
F12.3-1		(0)		(2)		(6)	
F12.3-2		(0)		(2)		(6)	
F12.3-3		(0)		(2)		(6)	
F12.3-4		(0)		(2)	(4)	(6)	
F12.3-5		(0)		(2)		(6)	
F12.3-6		(0)		(2)		(6)	
F12.3-7		(0)		(2)	(4)	(6)	
F12.3-8		(0)		(2)		(6)	
F12.3-9		(0)		(2)			
F12.3-10		(0)		(2)			
12.4-1		(0)					
12.4-2		(0)	(1)				
12.4-3		(0)		(2)		(6)	
T12.4-1		(0)					
T12.4-2		(0)					
T12.4-3		(0)		(2)			
12.5-1		(0)					
13-i		(0)	(1)				
13.1-1		(0)	(1)				
13.2-1		(0)	(1)				
13.3-1		(0)	(1)				(8)
13.3-2							(8)
13.3-3							(8)
13.3-4							(8)
13.3-5							(8)
13.3-6							(8)
13.3-7							(8)
13.3-8							(8)
13.4-1		(0)	(1)				
13.5-1		(0)	(1)				
13.6-1		(0)	(1)				
13.6-2		(0)	(1)				
F13.3-1							(8)
F13.3-2							(8)
F13.3-3							(8)

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 4

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 5

14-i		(0)		(2)			
14-ii		(0)					
14-iii				(2)			
14.1-1		(0)	(1)	(2)			
14.1-2		(0)		(2)			
T14-1	Sh. 1	(0)	(1)				
T14-1	Sh. 2	(0)		(2)			
T14-1	Sh. 3	(0)					
T14-1	Sh. 4	(0)					
T14-1	Sh. 5	(0)					
T14-1	Sh. 6	(0)	(1)				
T14-1	Sh. 7	(0)	(1)	(2)			
T14-1	Sh. 7a			(2)			
T14-1	Sh. 8	(0)		(2)			
T14-1	Sh. 9	(0)		(2)			
14.2-1		(0)					
14A-1				(2)			
14A-2				(2)			
F14A-1				(2)			
F14A-2				(2)			
F14A-3				(2)			
15-i		(0)					
15-ii		(0)					
15-iii		(0)					
15-iv		(0)					
15-v		(0)					
15-vi		(0)			(3)		
15-vii		(0)			(3)		(6)
15-viia							(6)
15-viii		(0)					
15-ix		(0)					
15-x		(0)		(2)			(6)
15-xa							(6)
15-xi		(0)		(2)			
15.1-1		(0)					
15.1-2		(0)					
15.1-3		(0)		(2)		(4)	(6)
15.1-4		(0)	(1)			(4)	(6)
T15.1-1	Sh. 1	(0)	(1)				
T15.1-1	Sh. 2	(0)	(1)			(4)	(6)
T15.1-1	Sh. 3	(0)				(4)	
F15.1-1		(0)				(4)	
F15.1-2		(0)				(4)	
F15.1-3		(0)				(4)	
F15.1-4		(0)				(4)	
15.2-1		(0)	(1)				
15.2-2		(0)	(1)	(2)			
15.3-1		(0)					
15.4-1		(0)					

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 5

15.4-2		(0)					(6)
15.4-3		(0)				(4)	
15.4-4		(0)					(6)
15.4-5		(0)	(1)			(4)	
T15.4-1	Sh. 1	(0)	(1)			(4)	
T15.4-1	Sh. 1a		(1)				
T15.4-1	Sh. 2	(0)	(1)			(4)	
T15.4-1	Sh. 3	(0)				(4)	
F15.4-1		(0)				(4)	
F15.4-2		(0)				(4)	
F15.4-3		(0)				(4)	
F15.4-4		(0)				(4)	
F15.4-5		(0)				(4)	
F15.4-6		(0)				(4)	
F15.4-7		(0)				(4)	
F15.4-8		(0)				(4)	
15.5-1		(0)					
15.6-1		(0)	(1)				
15.6-2		(0)	(1)	(2)			
15.6-3		(0)					
15.6-4		(0)		(2)		(4)	
15.6-5		(0)	(1)			(4)	(6)
15.6-6		(0)					
15.6-7		(0)			(3)		
15.6-8		(0)			(3)		
15.6-8a					(3)		
15.6-9		(0)			(3)		
15.6-10		(0)					
15.6-11		(0)		(2)	(3)		(6)
15.6-11a				(2)	(3)		
15.6-12		(0)		(2)	(3)		
15.6-13		(0)	(1)	(2)	(3)		
15.6-13a							(6)
15.6-14		(0)	(1)		(3)		(6)
T15.6-1	Sh. 1	(0)	(1)			(4)	
T15.6-1	Sh. 2	(0)				(4)	
T15.6-1	Sh. 3	(0)					
T15.6-2		(0)			(3)		
T15.6-3		(0)			(3-deleted)		
T15.6-4	Sh. 1	(0)			(3)		
T15.6-4	Sh. 2	(0)					
T15.6-4	Sh. 2a				(3)		
T15.6-4	Sh. 2b				(3)		
T15.6-5		(0)					
T15.6-6		(0)					
T15.6-7		(0)			(3)		
T15.6-8							(6)
T15.6-9							(6)
F15.6-1		(0)				(4)	

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 5

F15.6-2		(0)			(4)		
F15.6-3		(0)			(4)		
F15.6-4		(0)			(4)		
F15.6-5		(0)		(3)			
F15.6-6		(0)		(3)			
F15.6-7		(0)		(3)		(6)	
F15.6-8		(0)		(3)		(6)	
F15.6-9		(0)		(3)		(6)	
F15.6-10		(0)		(3)		(6)	
F15.6-11		(0)		(3)			
F15.6-12		(0)		(3)		(6)	
F15.6-13		(0)		(3)		(6)	
F15.6-14		(0)		(3)			
F15.6-15		(0)		(3)			
F15.6-16		(0)		(3)			
F15.6-17		(0)		(3)		(6)	
F15.6-18		(0)		(3)		(6)	
F15.6-19						(6)	
F15.6-20						(6)	
15.7-1		(0)	(2)				
15.7-2		(0)					
15.7-3		(0)	(2)				
15.7-4		(0)	(2)			(6)	
15.7-4a			(2)			(6)	
15.7-4b						(6)	
15.7-4c						(6)	
15.7-5		(0)				(6)	
15.7-6		(0)	(2)				
T15.7-1	Sh. 1	(0)					
T15.7-1	Sh. 2	(0)					
T15.7-2		(0)	(2)				
T15.7-3	Sh. 1	(0)	(2)				
T15.7-3	Sh. 2		(2)				
T15.7-4	Sh. 1		(2)				
T15.7-4	Sh. 2		(2)				
T15.7-4	Sh. 3		(2)				
T15.7-5			(2)				(7)
F15.7-1		(0)	(2)			(6)	
F15.7-2		(0)	(2)			(6)	
F15.7-3		(0)	(2)				
F15.7-4		(0)	(2)				
F15.7-5		(0)	(2)			(6)	
F15.7-6		(0)	(2)			(6)	
F15.7-7		(0)	(2)				
F15.7-8		(0)	(2)				
F15.7-9			(2)			(6)	
F15.7-10			(2)			(6)	
15.8-1		(0)					
15.A-1				(3)			

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 5

15.A-2				(3)			
15.A-3				(3)	(4)		
15.A-4				(3)	(4)	(6)	
15.A-5				(3)		(6)	(7)
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T15.A-1	Sh. 2			(3)			
i		(0)	(1)				
ii		(0)	(1)				
iii		(0)	(1)				
iv		(0)	(1)				
v		(0)	(1)				
vi		(0)	(1)				
vii-A		(0)	(1)				
viii		(0)	(1)				
ix		(0)	(1)				
x		(0)	(1)				
xi		(0)	(1)				
xii		(0)	(1)				
xiii-A		(0)	(1)				
xiv		(0)	(1)				
xv		(0)	(1)				
xvi		(0)	(1)				
xvii		(0)	(1)				
xviii		(0)	(1)				
0-1		(0)					
0-2		(0)					
1-1		(0)					
1-2		(0)					
1-3		(0)					
1-4		(0)					
1-5		(0)					
1-6		(0)					
1-7		(0)					
1-8		(0)					
2-1		(0)					
B2-1		(0)					
3/4 0-1		(0)					
3/4 1-1		(0)					
3/4 2-1		(0)					
3/4 3-1		(0)					
3/4 3-2		(0)					
3/4 3-3		(0)					
3/4 3-4	(T3.3-6)	(0)	(1)				
3/4 3-5	(T3.3-6 cont)	(0)	(1)				
3/4 3-6	(T4.3-3)	(0)					
3/4 3-7		(0)	(1)				
3/4 3-8		(0)					
3/4 3-9	(T3.3-7)	(0)					
3/4 3-10	(T4.3-4)	(0)					

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 5

3/4 3-11		(0)
3/4 3-12		(0)
3/4 3-13	(T3.3-9)	(0)
3/4 3-14	(T4.3-6)	(0)
3/4 3-15		(0)
3/4 4-1		(0)
3/4 4-2		(0)
3/4 4-3		(0)
3/4 4-4		(0)
3/4 4-5		(0)
3/4 4-6		(0)
3/4 4-7		(0)
3/4 4-8		(0)
3/4 4-9		(0)
3/4 4-10		(0)
3/4 4-11		(0)
3/4 4-12	(T4.4-2)	(0)
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3/4 4-14		(0)
3/4 4-15		(0)
3/4 4-16		(0)
3/4 4-17		(0)
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3/4 5-3		(0)
3/4 5-4		(0)
3/4 5-5		(0)
3/4 5-6		(0)
3/4 6-1A		(0)
3/4 6-2A		(0)
3/4 6-3A		(0)
3/4 6-4A		(0)
3/4 6-5A		(0)
3/4 6-6A		(0)
3/4 6-7A		(0)
3/4 6-8A		(0)
3/4 6-9A		(0)
3/4 6-10A		(0)
3/4 6-11A		(0)
3/4 6-12A		(0)
3/4 6-13A		(0)
3/4 6-14A		(0)
3/4 6-15A		(0)
3/4 6-16A		(0)
3/4 6-17A	(T3.6-1)	(0) (1)
3/4 6-18A	(T3.6-1 cont)	(0) (1)
3/4 6-19A	(T3.6-1 cont)	(0) (1)
3/4 6-20A	(T3.6-1 cont)	(0) (1)
3/4 6-21A	(T3.6-1 cont)	(0) (1)

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 5

3/4 6-22A	(T3.6-1 cont)	(0)
3/4 6-23A	(T3.6-1 cont)	(0)
3/4 6-24A	(T3.6-1 cont)	(0) (1)
3/4 6-25A	(T3.6-1 cont)	(0) (1)
3/4 6-26A		(0)
3/4 6-27A		(0)
3/4 6-28A		(0)
3/4 6-29A		(0)
3/4 6-30A		(0)
3/4 6-1B		(0)
3/4 6-1C		(0)
3/4 6-1D		(0)
3/4 7-1		(0)
3/4 7-2	(T3.7-1)	(0)
3/4 7-3	(T3.7-2)	(0)
3/4 7-4	(T4.7-1)	(0)
3/4 7-5		(0)
3/4 7-6		(0)
3/4 7-7		(0)
3/4 7-8		(0)
3/4 7-9	(T4.7-2)	(0)
3/4 7-10		(0)
3/4 7-11		(0)
3/4 7-12		(0)
3/4 7-13		(0)
3/4 7-14		(0)
3/4 7-15		(0)
3/4 7-16		(0)
3/4 7-17		(0)
3/4 7-18		(0)
3/4 7-19		(0)
3/4 7-20		(0)
3/4 7-21		(0)
3/4 7-22		(0)
3/4 7-23		(0)
3/4 7-24		(0)
3/4 8-1		(0)
3/4 8-2		(0)
3/4 8-3		(0)
3/4 8-4		(0)
3/4 8-5		(0)
3/4 8-6		(0)
3/4 8-7		(0)
3/4 8-8		(0)
3/4 8-9		(0)
3/4 8-10		(0)
3/4 8-11		(0)
3/4 9-1		(0)
3/4 9-2		(0)

EFFECTIVE PAGE LISTING
GIBBSSAR: VOLUME 5

TABLE 18.0-1
NRC QUESTION STATUS

Question Number	Response Transmitted via Amendment
005.1	6
005.2	6
005.3	6
005.4	6
005.5	This question to be withdrawn per meeting with NRC on 11-07-78
010.1	2
010.2	2
010.3	2
010.4	2
010.5	2
010.6	2
010.7	2
010.8	2
010.9	2
010.10	2
010.11	2
010.12	2
010.13	6
010.13A	8
010.14	6
010.15	6
010.16	8
010.17	6
010.18	6
010.19	6
010.20	6
010.21	6
010.22	6
010.23	6
010.24	6
010.25	6
010.26	6
010.27	6
010.28	6
010.29	6
010.30	6
010.31	6
010.32	6
010.33	6
010.34	7

TABLE 18.0-1 (Continued)
NRC QUESTION STATUS

Question Number	Response Transmitted via Amendment
010.35	6
010.36	6
010.37	6
010.38	6
010.39	none received
010.40	6
010.41	6
010.42	none received
010.43	6
010.44	6
010.45	6
010.46	6
010.47	6
010.48	6
010.49	6
010.50	6
010.51	6
010.52	6
010.53	6
010.54	6
010.55	6
010.56	6
010.57	6
010.58	6
010.59	7
010.60	6
010.61	6
010.62	6
010.63	6
010.64	8
010.65	6
010.66	7
010.67	6
010.68	6
010.69	6
010.70	6
010.71	6
010.72	6
010.73	6
010.74	6
010.75	6
010.76	none received
010.77	none received

TABLE 18.0-1 (Continued)
NRC QUESTION STATUS

Question Number	Response Transmitted via Amendment
010.78 through 010.103	response by 3/5/79
022.1	2
022.2	8
022.3	2
022.4	2
022.5	2, 6
022.6	6
022.7	7
022.8	6
022.9	8
022.10	6
022.11	6
022.12	6
022.13	6
022.14	6
022.15	6
022.16	6
022.17	6
022.18	6
022.19	6
022.20	6
022.21	6
022.22	6
022.23	7
032.1	2
032.2	2
032.3	2
032.4	2
032.5	2
032.6	2
032.7	2
040.1 through 040.75	response by 3/5/79
111.1	2
111.2	2
111.3	2
111.4	2
111.5	4
111.6	4
111.7	2
111.8	2
111.9	2
111.10	2
111.11	2

TABLE 18.0-1 (Continued)
NRC QUESTION STATUS

Question Number	Response Transmitted via Amendment
111.12	4
111.13	4
111.14	2
111.15	2
111.16	2
111.17	2
111.18	2
111.19	4
111.20	4, 7
111.21	5
111.22	2
111.23	2
111.24	2
111.25	4
111.26	2
111.27	2
111.28	2
111.29	4
111.30	4
111.31	4
111.32	4
111.33	4
111.34	4
111.35	4
111.36	4
111.37	4
111.38	4
111.39	4
111.40	7
111.41	7
111.42	7
111.43	8
111.44	7
111.45	7
111.46	7
111.47	7
111.48	7
111.49	7
111.50	7
111.51	7
111.52	7
111.53	7
111.54	7

TABLE 18.0-1 (Continued)
NRC QUESTION STATUS

Question Number	Response Transmitted via Amendment
111.55	9
111.56	9
121.1	2
121.2	2
121.3	5
121.4	5
121.5	5
122.1	4
122.2	4
122.3	5
122.4	4
122.5	4
122.6	5
122.7	9
122.8	9
122.9	9
122.10	9
122.11	9
131.1	2
131.2	4
131.3	2
General Comments A	6
General Comments B	5
131.1	5
131.2	5
131.3	5
131.4	5
131.5	5
131.6	5
131.7	5
131.8	5
131.9	5
131.10	6
131.11	6
131.12	5
131.13	5
131.14	5
131.15	5
131.16	5
131.17	5
131.18	5
131.19	5
131.20	5

TABLE 18.0-1 (Continued)
NRC QUESTION STATUS

Question Number	Response Transmitted via Amendment
131.21	5
131.22	5
131.23	5
131.24	5
131.25	5
131.26	5
131.27	5
131.28	5
131.29	5
131.30	5
131.31	5
131.32	6
131.33	5
131.34	6
131.35	5
131.36	5
131.37	7
131.38	5
131.39	5
131.40	5
131.41	5
131.42	5
131.43	5
131.44	5
131.45	5
131.46	5
131.47	5
131.48	5
131.49	5
131.50	5
131.51	5
131.52	8
131.53	5
131.54	5
131.55	5
131.56	8
131.57	8
131.58	8
131.59	8
131.60	8
131.61	8
131.62	8
131.63	8

TABLE 18.0-1 (Continued)
NRC QUESTION STATUS

Question Number	Response Transmitted via Amendment
131.64	8
131.65	8
131.66	8
131.67	8
131.68	8
131.69	8
131.70	8
131.71	8
131.72	8
131.73	8
131.74	8
131.75	8
131.76	8
212.1	4
212.2	5
212.3	5
212.4	5
212.5	4
212.6	5
212.7	5
212.8	4
212.9	4
212.10	4 and 5
212.11	5
212.12	5
212.13	4
212.14	5
212.15	4
212.16	4 and 5
212.17	4
212.18	4
212.19	5
212.20	4
212.21	4
212.22	5
212.23	5
212.24	5
212.25	5 and 7
212.26	4
212.27	4
212.28	4
212.29	7
212.30	7

TABLE 18.0-1 (Continued)
NRC QUESTION STATUS

Question Number	Response Transmitted via Amendment
212.31	7
212.32	7
212.33	7
212.34	7
212.35	8
212.36	7
212.37	7
212.38	7
221.1	7
222.1	8
222.2	8
222.3	8
222.4	Response to be submitted upon completion of analysis by 3/5/79
222.5	8
222.6	8
311.1	2
311.2	2
311.3	2
311.4	2
311.5	2
311.6	2
311.7	2
311.8	2
311.9	3
311.10	3
311.11	2
311.1	6
311.2	7
311.3	5
311.4	5
311.5	6
311.6	5
311.7	5
311.8	6
311.19	8
311.20	8
311.21	8
320.1	2
320.2	2
321.1	6
321.2	6

TABLE 18.0-1 (Continued)
NRC QUESTION STATUS

Question Number	Response Transmitted via Amendment
321.3	6
321.4	6
321.5	6
321.6	6
321.7	6
321.8	6
321.9	6
321.10	6
321.11	6
321.12	6
321.13	6
321.14	6
321.15	6
321.16	8
321.17	8
321.18	8
321.19	8
321.20	8
321.21	8
321.22	8
321.23	8
321.24	8
321.25	8
331.1	2
331.2	2
331.3	2
331.4	2
331.5	2,6
331.6	2
331.7	2
331.8	6
331.9	7
331.10	6
331.11	6
331.12	6
331.13	7
371.1	2
371.2	2
421.0	2
423.1	2
423.2	2
432.0	8

TABLE 3.2.-1 (Sheet 6 of 21)

CLASSIFICATION OF COMPONENTS, AND SYSTEMS 5

System Components	ANSI Classification (Note 1)	Construction Codes and Standards (Note 2)
Piping and valves		
a. Required for the performance of safety functions of Safety Class 2 components which are not in service during any normal mode of plant operation and are not testable	2	g.2)
b. Required for performance of safety functions of Safety Class 2 components	2	g.2)
c. Required for performance of safety functions of Safety Class 3 components	3	g.3)
Bypass line orifice	3	g.3)
Auxiliary Feedwater System		
Auxiliary feedwater storage tank	3	g.3)
Pumps (motor- and turbine-driven)	3	g.3)
Piping and valves	3	g.3)

TABLE 3.2.-1 (Sheet 7 of 21)

CLASSIFICATION OF COMPONENTS, AND SYSTEMS 5

System Components	ANSI Classification (Note 1)	Construction Codes and Standards (Note 2)	
Main Steam System			
Piping and valves from the from the steam generator nozzle up to and including the main steam stop valves	2	g.2)	9
Safety valves up to and including the discharge nozzle flange	2	g.2)	
Power-operated relief valves (valve body only)	2	g.2)	
Outside the containment from the main steam stop valves to the turbine generator set	NNS	e.3)	5
Feedwater System			
Piping and valves			
a. From containment isolation valves to the steam generators	2	g.2)	
b. From containment isolation valves to & including feedwater control and bypass valves	3	g.3)	9
c. Outside the containment from the feedwater control valves to the feedwater pumps	NNS	e.3)	

TABLE 3.2.-1 (Sheet 8 of 21)

CLASSIFICATION OF COMPONENTS, AND SYSTEMS 5

System Components	ANSI Classification (Note 1)	Construction Codes and Standards (Note 2)
Emergency Diesel Fuel Oil Storage and Transfer System		
Transfer pumps	3	g.3)
Storage tanks	3	g.3)
Day tanks	3	g.3)
Diesel fuel oil filter	3	g.3)
Diesel fuel oil strainer	3	g.3)
Piping and valves a. Required for continuous functioning of diesel generators	3	g.3)
b. Normally or automatically isolated from Safety Class 3 components	NNS	e.3)
Containment Spray System		
Refueling water storage tank	2	g.2)
Containment spray pumps	2	g.2)
Spray additive tank	2	g.2)

9

1

TABLE 3.2.-1 (Sheet 9 of 21)

CLASSIFICATION OF COMPONENTS, AND SYSTEMS 5

System Components	ANSI Classification (Note 1)	Construction Codes and Standards (Note 2)
Piping and valves		
a. Required only for injection of spray additive	2	g.2)
b. Required for long-term recirculation of containment sump water for spray	2	g.2)
c. Spray additive tank drains and samples (up to first valve)	3	g.3)
d. Normally or automatically isolated from parts of the system covered in a or b	NNS	e.3)
Chemical eductor	2	g.2)
Spray nozzles	2	g.2)
Containment sump valve isolation tanks	2	g.2)
Mini recirculation pipe orifice	2	g.2)
Ring header line orifice	2	g.2)

TABLE 3.2.-1 (Sheet 10 of 21)

CLASSIFICATION OF COMPONENTS, AND SYSTEMS 5

System Components	ANSI Classification (Note 1)	Construction Codes and Standards (Note 2)	
Containment Isolation System			
a. System piping and valves of all systems penetrating containment from first isolation barrier inside containment to the first isolation barrier outside containment, which are included as part of containment isolation system	2	g.2)	9
Demineralized and Reactor Makeup Water System			
Reactor makeup water storage tank	NNS	g.5)	9
Reactor makeup water pumps	NNS	g.w)	
Piping and valves	NNS	e.3)	

3.6 Protection Against Dynamic Effects Associated With the Postulated Rupture of Piping

This section describes design bases and measures that have been used to ensure that the containment vessel and all essential equipment inside or outside the containment, including components of the RCPB, ESF, and safety-related components, have been adequately protected against the effects of blowdown jets, reactive forces, and pipe whip resulting from postulated rupture of piping. 1

The criteria for protection against pipe whip within the containment conform to NRC Regulatory Guide 1.46.(1) The criteria for protection against pipe break outside the containment conform to the guidelines contained in Branch Technical Positions APCSB-3-1 and MEB-3-1.(3)

The protection of safety-related structures, systems, and components against postulated piping failures in high- or moderate-energy fluid systems that operate during normal and upset plant conditions is ensured by the following: 1

a. To the extent practicable, by separation or remote location from pipes subject to postulated ruptures

b. Where separation is not feasible, by isolation of the pipes subject to rupture

c. Where neither separation nor isolation is practicable, by an arrangement of pipe whip restraints and jet impingement barriers

3.6.1 Postulated Piping Failures in Fluid Systems Outside of Containment

3.6.1.1 Design Bases

Any fluid system or piping run within the plant that, during normal operating plant conditions, has a maximum operating temperature exceeding 200 F or a maximum operating pressure exceeding 275 psig, or both, can be subject to a postulated pipe break.

Any fluid system or piping run with normal operating conditions of 200 F or less and 275 psig or less can be subject to pipe cracks. The internal energy of the fluid in these systems is not sufficient to cause a pipe break.

Ruptures or cracks within high- or moderate-energy systems are not postulated to occur within 24 hours prior to or following a LOCA.

The essential systems and components which are required to
shutdown the reactor and mitigate the consequence of a postulated
pipe rupture outside containment as defined in Table 15.4-12 of 6
FESAR 414 will be protected following a postulated piping failure
outside the containment.

a. High-Energy Fluid Systems

The high-energy fluid systems subject to pipe breaks outside the containment building are identified in Table 3.6-1.

There are no safety-related systems, structures or components located in the turbine building. Rupture of pipes located inside the turbine building will only be considered for cases where the impact of a whipping pipe or jet impingement force could cause damage to a safety-related structure adjacent to the turbine building e.g. auxiliary building wall. In those cases, the structure will be designed to withstand the effects of a postulated pipe rupture of a high energy fluid system in the turbine building, employing the use of energy absorbing material (EAM) and/or suitable structures.

For Main Steam and Feedwater lines as shown on Figures 3.6-1a and 1
3.6-1b between the containment isolation valves and containment
penetrations, breaks will not be postulated when the piping meets
the requirements of BTP MEB 3-1, otherwise protection is provided
in accordance with Branch Technical Position APCSB 3-1 for 9
safety-related systems, structures or components by use of
barriers.

b. Moderate-Energy Fluid Systems

The moderate-energy fluid systems which are considered for
eventual postulated through-wall pipe cracks are described in
subsections 3.6.1.2,b. and 3.6.1.2,c. 1

Moderate-energy systems which are located inside the turbine
generator building are not included because there are no safety
related structures, systems or components located inside the 1
turbine building.

Moderate-energy fluid systems which are located outside the containment building are identified in Table 3.6-2.

accordance with Reference (2) longitudinal breaks are not required at terminal points of seamless piping, nor at intermediate locations where stresses are below 0.8 (1.2 S + S), and a minimum number of break locations must be satisfied. For pipe runs which are partially Class 1 and partially Class 2 and both parts run between the same two terminals used as anchor points for thermal analysis the longitudinal and circumferential pipe breaks are not postulated on the Class 2 portion if the stress on Class 1 portion calculated using Eq. 10 per NB-3653 are above 2.4 Sm and the sum of the stresses calculate using Eq. 9 and 10 per NC-3652 are below 0.8 (1.2 S + S). 7

3. Non-Nuclear Systems

Breaks in non-nuclear class piping are postulated at the following locations in each piping or branch run.

a) At terminal ends of the run

b) At each intermediate pipe fittings, welded attachment, and valve.

2

3.6.2.1.2 Postulated Break and Leakage Locations of Fluid System Piping Outside Containment

a. High-Energy Fluid Systems 2

Criteria for the protection of safety-related systems, structures, and components are provided in accordance with requirements of Branch Technical Position MEB 3-1. In addition to meeting the criteria of position B.1.b, all piping in the containment penetration area will have a 100 percent volumetric examination of all circumferential and longitudinal welds during each inspection interval (IWA-2400 of Section XI of the ASME Code.) 9

2

TABLE 3.6-1
(Sheet 1 of 3)

HIGH-ENERGY FLUID SYSTEMS LOCATED OUTSIDE THE CONTAINMENT
(WESTINGHOUSE-414)

Systems	Critical Portion	Operating Temperature	Conditions Pressure	System Reference Information	Protection of Safety Systems (Note 3)	Remarks	
Main steam system	From first restraint beyond the main steam stop valve to the turbine building including the steam supply line to auxiliary feedwater pump turbine	548 F	1035 psia	GIBBSSAR 10.3	(1) & (3)		6 9
Condensate and feedwater systems	Piping downstream of condensate pumps up to containment isolation valves	440 F**	1300 psia*	GIBBSSAR 10.4.7	(1) & (3)	*Pressure downstream of the steam generator feedwater pump; **temperature downstream of high-pressure heater No. 1	6 9 6
Steam generator blowdown and cleanup system	Piping from containment isolation valve to the pressure control valve downstream of the heat exchanger	500 F	1000 psia	GIBBSSAR 10.4.8	(2) & (3)	Heat exchanger outlet temperature approximately 135 F PCV outlet pressure 275 psia	9 6
Process sampling	Tubing from containment isolation valve to pressure control valve downstream sample coolers	650 F	2500 psia	GIBBSSAR 9.3.2	--	Primary sampling lines; 3/8-inch tubing; no breaks are postulated	9
Auxiliary steam	All piping within the auxiliary and safety features buildings	>212 F	Varies	(See Note 1)	(1), (2), & (3)		6
Main Steam System	AFW pump turbine steam supply up to control valve	548 F	1035 psia	GIBBSSAR 10.3.3.6	(2) & (3)		9

TABLE 3.6-1
(Sheet 2 of 3)

HIGH-ENERGY FLUID SYSTEMS LOCATED OUTSIDE THE CONTAINMENT
(WESTINGHOUSE-414)

9

Systems	Critical Portion	Operating Temperature	Conditions Pressure	System Reference Information	Protection of Safety Systems (Note 3)	Remarks
Condensate return	All piping within the auxiliary and safety features buildings	200-211 F	Atmospheric	(See Note 1)	(1), (2), & (3)	
Extraction steam	None	Varies	Varies	GIBBSSAR 10.3	--	Entire system located inside the turbine building
Heater drain system	None	Varies	Varies	(See Note 2)	--	Entire system located inside the turbine building
Auxiliary feedwater system	AFWS discharge line between pump and main feedwater header	40-100 F	Varies	GIBBSSAR 10.4.9	(2) & (3)	
CVCS	Letdown line up to PCV-131	380/115 F	300 psig	GIBBSSAR 9.3	(1) & (3)	Including loop through the tube side of the letdown reheat heat exchanger
	Charging line	130 F	2400 psig		(1) & (3)	From charging pumps to containment penetration
	Alternate charging line	130 F	2400 psig		(1) & (3)	Via SIS system up to valves 8803 A and B
	Reactor coolant pump seal injection line	115 F	2400 psig		(1) & (3)	From charging pumps to containment penetration

6

Note 1

The auxiliary steam system provides process steam for equipment that operates during plant shutdowns, i.e., evaporators. The system consists of an auxiliary boiler and a piping distribution system with pressure control valves as required. The condensate return system is a closed system with the function of collecting the condensed steam and returning it to a collecting tank inside the turbine building. Condensate is created at low points to the auxiliary steam system and at equipment serviced by the auxiliary steam.

3.10 Seismic Qualification of Seismic Category I Instrumentation and Electrical Equipment

3.10.1 Seismic Qualification Criteria

The major items of seismic Category I instrumentation and electrical equipment which require seismic qualification are as follows:

a. 6900-V switchgear (nuclear safety-related)

b. 6900 to 480-V transformers (associated with nuclear-safety-related buses)

c. 480-V switchgear motor control centers and starters (nuclear safety-related) 9

d. 125-V station batteries and racks (nuclear safety-related

e. 480-Vac to 125-Vdc battery chargers (nuclear safety-related)

f. 125-Vdc panels and switchgear (nuclear safety-related)

g. 125-Vdc to 120-Vac inverters (nuclear safety-related)

h. Instrument bus panels (nuclear safety-related)

i. Containment penetration assemblies

j. Non-Class IE electrical equipment and supports, unless equipped with qualified restraining devices, when located near safety related equipment, to prevent them from damaging the safety-related equipment during an SSE. 9

k. Diesel generator and accessories

l. Diesel generator control panels

m. Relay boards and racks (nuclear safety-related)

n. Instruments, instrument panels and racks (nuclear safety-related) 9

o. Hot shutdown panel (used if control room is evacuated)

p. Wire and cable raceway and duct banks system (nuclear safety-related)

q. Electrical supports (nuclear safety-related)

r. Motors (nuclear safety-related)

s. Instruments and controls for use in seismic Category I mechanical components and systems identified in Table 3.2-1. 9

t. Main control board

Seismic Category I instrumentation and other electrical equipment, including standby power system, are designed to maintain functional integrity during SSE and postaccident operation. Seismic design of the reactor protection system and ESF circuits is discussed in Section 3.10 of the NSSS SSAR.

Horizontal and vertical ground accelerations during an SSE are used to formulate floor-response spectra at each equipment location as described in subsection 3.7.2.1,c. Where practicable, equipment is tested in the operational condition. Operability is verified during and after testing. Deformation criteria for electrical equipment is consistent with subsection 3.7.2.1,d.

Suppliers are required to furnish documentation of actual test results or, if an analytical approach is used, detailed computations, to substantiate equipment capability to perform its intended function under the specified conditions.

Seismic Category I instrumentation and electrical equipment are to be seismically qualified in accordance with the procedures and documentation requirements specified in IEEE Standard 344-1975, Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations as augmented by Regulatory Guide 1.100, Seismic Qualification of Electric Equipment for Nuclear Power Plants. Where the requirements of 2
IEEE 344 conflict with those enumerated in subsection 3.7.2.1,c., the requirements of subsection 3.7.2.1,c. prevail.

The requirements of 10 CFR Part 50, Appendix A, GDC 2, Design Bases for Protection Against Natural Phenomena, are met as described in subsection 3.1.2.1,b. The requirements of 10 CFR Part 50, Appendix B, Criterion III, Design Control, are met as shown in section 17.1. The extent to which the recommendations for electrical control devices in NRC Regulatory Guide 1.29, Seismic Design Classification, Revision 1, are met is shown in subsection 3.2.1.

TABLE 6.1-6

CONTAINMENT SPRAY SYSTEM FLOW TIMES AND SOLUTION pH (WESTINGHOUSE-414)

	Duration of Containment Spray Injection Phase (min)	Solution pH After Injection: Without Chemical Additive Tank Stop Valve Failure	Solution pH After Injection: With Chemical Additive Tank Stop Valve Failure	
Minimum spray operation and minimum ECCS operation	81.42	8.6	8.6	9
Minimum spray operation and maximum ECCS operation	75.78	8.6	8.6	9
Maximum spray operation and minimum ECCS operation	45.69	8.6	8.6	9
Maximum spray operation and maximum ECCS operation	43.23	8.6	8.6	9

6.2.2 Containment Heat Removal Systems

A completely redundant containment spray system, designed to provide emergency containment heat removal in the event of a LOCA, is provided. This system, in conjunction with the emergency core cooling system, removes thermal energy from the containment environment following a LOCA or a main steam line break inside the containment to reduce the containment pressure and temperature. The containment ventilation system is not designed for continued operation during a design basis LOCA. The containment ventilation system is designed for normal plant operation; it is described in subsection 9.4.6. Major components of the containment spray system include the refueling water storage tank, containment spray pumps, spray headers, nozzles, and containment recirculation sumps. 9

By reducing the pressure differential between the containment and the environment and, therefore, reducing the driving force for 9
leakage of fission products from the containment atmosphere, the containment sprays also help to limit offsite radiation levels. The containment spray system also provides an effective means of removing postaccident radioiodine from the containment atmosphere. The fission product removal function of the spray systems is described in subsection 6.5.2

6.2.2.1 Design Bases

The containment heat removal systems are designed and tested in accordance with GDC 38, 39, 40, and 50 of 10CFR Part 50, Appendix A. The sources and amounts of energy that are taken 9
into consideration in sizing each heat removal system are described in subsection 6.2.1.1.

The containment spray system can remove sufficient energy to maintain the pressure below the containment design pressure, even in the event of a single active failure during injection phase and either a single active or passive failure during recirculation phase. The systems are supplied from separate Class 1E power buses, described in Section 8.3. No single failure can cause loss of more than half of the installed 9
200-percent-cooling capacity.

The containment spray system is designed to permit periodic determination of proper functioning to demonstrate system readiness. Routine testing is performed periodically to verify the operability of active containment spray system components.

The containment spray system is seismic Category I and ANSI
safety Class 2. 1

Containment spray system components are designed to remain
operable in the post-DBA environment. (Qualification criteria 9
are discussed in Section 3.11.)

The containment spray system is designed to withstand the dynamic
effects associated with a pipe rupture in a high-energy system.
The containment recirculation sumps provide a source of spray
water during the recirculation phase of the containment spray
system operation. The sumps are designed to promote mixing of 9
ECC and CS system fluids thus providing for sufficient heat
removal capacity to maintain containment pressure below the
design value for all cases of postulated loss-of-coolant
occurrences.

The containment spray system is the only heat removal system used to cool the containment environment during postaccident conditions.

6.2.2.2 System Design

The containment spray system (flow diagram on Figure 6.2-25)
consists of two separate and independent 100-percent-capacity
trains. Each train consists of one pump, spray ring headers,
nozzles, valves, connecting piping, a common refueling water
storage tank, and a common spray additive tank. Water from the
refueling water storage tank is used for containment spray during 9
the initial phase of a LOCA. After the supply of water from the
refueling water storage tank is exhausted, water is recirculated
from the containment recirculation sumps.

The containment spray system is designated as ANSI Safety Class 2 and designed as a seismic Category I system. Component design parameters are presented in Table 6.2-18. The codes and standards used as a basis for the design are given in Table 3.2-1.

A failure analysis of all active components of the heat removal systems during the injection phase and all active and passive components during the recirculation phase shows that the failure of any single component does not prevent the system from

fulfilling its design function. (This analysis is summarized in Table 6.5-4.) 1

The system design permits functional testing of the containment spray pumps at 100-percent flow and integrity testing of individual components. The active valves are periodically exercised to verify operability.

The following are discussed in subsection 6.5.2: the plant protection system signals and set points that actuate the containment spray system; the time, following the worst possible accident, that the containment spray system is assumed to be fully operational; the delay times, following receipt of the system actuation signals, that are inherent in bringing the system into service; and the extent to which the containment spray system and system components are required to be remote manually operated from the main control room.

Tests and inspections performed on system components are discussed in subsection 6.5.2.4.

The mechanical components of the containment spray system are described in this subsection. The parts of the system in contact with borated water are stainless steel or an equivalent corrosion-resistant material.

a. Refueling Water Storage Tank

This tank is located inside the auxiliary building and functions as a source of emergency borated cooling water for injection purposes. The RWST is of seismic Category I construction. The tank enclosure area is designed to seismic Category I requirements and provides missile protection for the tank. The tank is vented to of the auxiliary building.

The tank is normally used to fill the refueling canal for refueling operations. During all other plant operating periods, it is aligned to the suction of the low head (RHR) and high head
safety injection pumps, and containment spray pumps. The tank is
of stainless steel construction, with a leak detection system. 4
The tank has a total capacity of 570,000 gallons; 500,000 gallons
is the total usable volume for injection. A volume of
270,000 gallons is used during the first phase of injection when 9
RHR, high head safety injection and containment spray pumps take
suction from the refueling water storage tank. A volume of 4

230,000 gallons is used during the second phase of injection when only the containment spray pumps take suction from the refueling water storage tank. A volume of 4

70,000 gallons is not used for injection but provides margin and 4
outlet nozzle coverage.

b. Containment Spray Pumps

The containment spray pumps are of the vertical centrifugal type,
driven by electric motors connected to separate Class 1E buses,
as described in Section 8.3. Two pumps are provided (one for
each train), each having 100-percent-capacity, for complete 1
redundancy. They are located on the lowest elevation of the
safety features building.

c. Deleted 9

d. Spray Nozzles

See subsection 6.5.2.1 for a description of the spray nozzles and
the size distribution of the droplets produced. There are four
ring headers per train, physically located at different
elevations at the uppermost part and supported from the
containment dome. In addition, there are three headers per train
at lower floor elevations to ensure heat removal in 4
subcompartments that are enclosed.

The spray water flow path is as follows: water flows from the
spray nozzles; falls through the containment atmosphere; washes
the containment walls; passes through the operating floor
grating; and washes down the reactor vessel head, steam
generators, reactor coolant pumps and piping, primary shield
walls, floors, and drains through floor drain systems, overflows
the containment sump and thereby reaches the containment 9
recirculation sump.

e. Containment Recirculation Sumps 9

The containment recirculation sumps are enclosed by a protective 7
screen, as shown on Figure 6.2-27.

Redundant sumps are provided. The clogging of one sump does not prevent the redundant system from providing the required containment spray recirculation flow. The design of the sumps is
in accordance with Regulatory Guide 1.82. 4

The sumps are located on the lowest floor elevation in the containment, exclusive of the reactor cavity. The sump intake is protected by an outer trash rack, a coarse screen, and a fine inner screen. The sump screens are not depressed below the floor elevation.

All floor drains from the upper regions of the containment terminate in the containment sump (leak detection sump), thereby preventing direct streams of water, which may contain entrained
debris, from impinging on the recirculation sump intake filter 7
assemblies.

The trash rack is provided to prevent large debris from reaching the inner screens. The maximum design velocity of 0.2 ft/sec at the coarse screen allows debris with a specific gravity of 1.05
or more to settle before reaching the fine screen. The available 4
surface area used in determining the design coolant velocity is based on one-half of the free surface of the fine screen to conservatively account for partial blockage.

The trash rack and screens are designed to withstand the vibratory motion of the SSE without loss of structural integrity. 1

The fine screen is 7 mesh, per linear inch, 0.041-inch wire. This 0.102 inch square clear opening gives 51 percent open area.
The opening in the fine screen is based on the minimum clearance 4
between grid assemblies and fuel rods in the reactor core.

1

The pump intake design in the recirculation sump is carefully 7
established to prevent degrading effects such as vortexing on the pump performance.

Inservice inspection requirements for the sumps will include inspection of the trash racks, screens and pump suction inlet openings during every refueling outage. The inspection will be a visual examination of these areas for evidence of structural distress or corrosion.

The screens are constructed from stainless steel or an equivalent resistant material to avoid degradation during periods of inactivity and to ensure compatibility with the recirculated coolant. The containment sump collects the mixture of containment spray and ECCS water; it is the only source of water for the ECCS and containment spray systems during the long-term core cooling and containment atmosphere cleanup period. To ensure that air binding of the ECCS pumps does not occur during the recirculation phase of a LOCA, the piping, from the containment recirculation sump to the first containment sump isolation valve, is arranged so that as water enters the line, 7
all air in the line is vented back into the containment.

Both containment recirculation sumps collect postaccident water spilled on the floor and overflowed from the containment sump at elevation 90 feet, 6 inches. If one recirculation sump is not operating, the other handles the total flow required to fulfill the minimum ESF functions.

Each containment recirculation sump is connected through separate suction pipes to one containment spray pump and one RHR pump. Each suction pipe is inserted into a containment sleeve and creates, in conjunction with circular seals welded to both pipes, an extended containment barrier.

Since the containment recirculation sumps are entirely within the containment and form part of the containment structure, they are subject to the same initial integrated leak rate testing at design pressure as the containment. Provisions are made in the 9
containment design to permit periodic leakage rate tests as discussed in subsection 6.2.6.1,C, to verify the continued leaktight integrity of the containment.

During post-LOCA conditions in the containment, particulate matter such as concrete, glass, metal chips, paint, and thermal insulation could be released. Some larger particles, such as wire or structural metal could fall into the recirculated water.

Paints and thermal insulation are selected for their resistance to post-LOCA containment environment, thus reducing the amount of debris collected in the sump area. The water entering the suction pipe may contain a small amount of particles which have a 9
diameter of less than 1/8 inch; it cannot clog the containment spray nozzles. (The diameter of each orifice is 3/8 inch, which

is larger than the diameter of the holes in the last series of screens in the containment sump.)

During the recirculation phase, the containment spray system can accommodate small quantities of debris, i.e, fragments of insulating materials, paint flakes or dust which may enter the suction lines.

Following a pipe rupture, parts of the component insulation will become dislodged due to pipe severance or jet intercept or both. 6

Portions of the dislodged insulation will disintegrate while the remainder will stay structurally intact.

The disintegrated insulation, whether encapsulated mass-insulation or reflective insulation, will create a potential 7
for strainer or drain line clogging.

Due to the weight of the insulation panels described below, dislodged but intact panels will not be carried or moved by the low-velocity drainage flow within the containment and are therefore not considered to present any further hazards to the containment recirculation system.

Analysis of the potential locations of the major pipe ruptures where containment recirculation is required, indicates that all 6
such locations are remote from the containment recirculation strainers. Further, the study indicates that there is no direct access between the break locations and the strainers.

With this arrangement, a large portion of the disintegrated insulation will become trapped by the barriers created by gratings, piping, structures and other components, thereby ascertaining that the amount of insulation reaching the screens will be minimized.

The four Main Steam lines are located above the operating deck on elevation 150'-11" and 171'-11" and have as such a potential for
clogging the refueling canal drain, should a pipe break occur. 7
However, a large portion of these lines are shielded by the Steam 9
Generator Compartments and run an opposite sides of containment,
thereby limiting the direct access to the refueling canal. 7
Redundant drains are installed in the refueling canal as shown in 9
Figure 6.2-35.

The feedwater lines are all routed above the operating deck at elevation 124'-6", thereby ensuring that the insulation will not 6
reach the Refueling Canal. The line routing further provides a

full concrete floor separation between any break in the pipe and the containment recirculation strainers.

All Reactor Coolant pipe ruptures are confined within the Steam Generator Compartments or at the Reactor Vessel nozzles.

Dislodged Reactor Vessel Insulation will be confined inside the incore instrumentation tunnel with no access to the recirculation screens. 6

Disintegrat... insulation within the Steam Generator Compartment, from either Reactor Coolant, Feedwater or Main Steam line breaks within these compartments, will to a large extent become trapped on the numerous components or structures located within this compartment. Insulation reaching the lower elevation of this compartment will not be carried by the low velocity water draining through the labyrinth doorways.

To ensure the above assumptions, all safety class 1 components will have either reflective or encapsulated insulation. 7

Safety class 2 and 3 components will have either encapsulated or jacketed mass-insulation. Where it can be determined that a potentially hazardous amount of insulation may become dislodged as a result of a pipe rupture, the applicable portion will have encapsulated insulation to minimize the amount of insulation which will dislodge and disintegrate at a jet impact. 6

The reflective and the encapsulated insulation will be supplied in fully enclosed sections or segments.

All insulation will be designed and installed to withstand the effects of containment spray.

f. Spray Additive Tank and Eductor Nozzles are discussed in Chapter 6.5. 9

The following will be discussed in the FDR: the materials used i... the insulation; the behavior of the insulation during and after a LOCA; the tests performed or reference test reports that determine the behavior of the insulation under simulated LOCA conditions and the methods of attaching the insulation to piping and components. 1

6.2.2.3 Design Evaluation

A discussion of the drop size spectrum (mean drop size emitted) and the pressure drop across the nozzles is given in subsection 6.5.2. A discussion of the volume of the containment covered by the sprays, the spray system flow rate, the mean spray drop size, and an analysis of the heat removal capability of the containment spray, is given in subsection 6.5.2.

The Containment Spray pumps are designed to perform at rated 7
capacity against a total head which is the sum of the containment
design pressure (50 psig), plus nozzle elevation head (285 feet), 9
plus nozzle pressure drop (40 psi), plus line losses and margin.
One pump is sufficient to deliver the required quantity of
cooling water. 7

Sufficient NPSH is available to the containment spray pumps for both modes of operation, injection and recirculation.

full concrete floor separation between any break in the pipe and the containment recirculation strainers.

All Reactor Coolant pipe ruptures are confined within the Steam Generator Compartments or at the Reactor Vessel nozzles.

Dislodged Reactor Vessel Insulation will be confined inside the 6
incore instrumentation tunnel with no access to the recirculation screens.

Disintegrated insulation within the Steam Generator Compartment, from either Reactor Coolant, Feedwater or Main Steam line breaks within these compartments, will to a large extent become trapped on the numerous components or structures located within this compartment. Insulation reaching the lower elevation of this compartment will not be carried by the low velocity water draining through the labyrinth doorways.

To ensure the above assumptions, all safety class 1 components
will have either reflective or encapsulated insulation. 7

Safety class 2 and 3 components will have either encapsulated or jacketed mass-insulation. Where it can be determined that a potentially hazardous amount of insulation may become dislodged as a result of a pipe rupture, the applicable portion will have encapsulated insulation to minimize the amount of insulation which will dislodge and disintegrate at a jet impact. 6

The reflective and the encapsulated insulation will be supplied in fully enclosed sections or segments.

All insulation will be designed and installed to withstand the effects of containment spray.

f. Spray Additive Tank and Eductor Nozzles are discussed in 9
Chapter 6.5.

The following will be discussed in the FDR: the materials used 1
for the insulation; the behavior of the insulation during and after a LOCA; the tests performed or reference test reports that determine the behavior of the insulation under simulated LOCA conditions; and the methods of attaching the insulation to piping and components.

a. General Leakage-Rate Tests

Containment leakage testing is in accordance with all the requirements of 10 CFR Part 50, Appendix J, Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors.

After the Containment is pressurized and the Containment air conditions are stabilized the following parameters are measured and recorded periodically for the duration of the test. 9

1. Containment absolute pressure 6

2. Containment dry bulb temperature

3. Containment wet bulb temperature

4. Weather conditions outside of Containment.

b. Preoperational Leakage-Rate Tests

After completion of containment construction and installation of all mechanical, fluid, electrical, and instrumentation systems penetrating the containment pressure boundary, preoperational integrated leakage rate Type A tests, using a reduced pressure test program, are conducted in accordance with 10 CFR Part 50, Appendix J. Tests are performed at the calculated peak containment internal pressure and at a reduced pressure (for calculated peak containment internal pressure, see subsection 6.2.1). 6

c. Periodic Leakage-Rate Tests

Periodic leakage-rate tests, Type A (at a reduced pressure of half of the calculated peak containment internal pressure), are performed in accordance with the requirements of 10 CFR Part 50, Appendix J, including the retest schedules. 6

d. Acceptance Criteria

The maximum allowable leakage rate (La, as defined in 10 CFR Part 50, Appendix J) in a 24-hour period, when related to the maximum containment leakage under DBA conditions, is 0.20 percent of the weight of contained air at the calculated peak containment internal pressure. 1

The acceptance criteria for all the leak tests are in accordance with 10 CFR Part 50, Appendix J.

The initial reduced pressure Type A integrated leak rate (Ltm) does not exceed 75 percent of the allowable reduced pressure leakage rate (Lt as defined in 10 CFR Part 50, Appendix J). 9

The periodic Type A reduced pressure integrated leak rate (Ltm) does not exceed 75 percent of Lt, as calculated in 10 CFR Part 50, Appendix J.

e. Containment Inspection

A detailed visual inspection of the accessible interior and exterior surfaces of the containment structure is performed prior to any Type A integrated leakage-rate test to uncover any evidence of structural deterioration which may affect either the containment structural integrity or leaktightness. The discovery of any significant deterioration prompts corrective actions in accordance with acceptable procedures. Inspection procedures are in accordance with 10 CFR Part 50, Appendix J.

f. Reports

Test reports are prepared and submitted in accordance with the requirements of 10 CFR Part 50, Appendix J.

g. Corrective Action

1) If, at any time, it is determined that the acceptance criteria limits are exceeded, repairs will be initiated immediately.

2) Repairs are made in accordance with the applicable codes stated in subsections 3.8.1 and 3.8.2. After the repairs have been completed, another test is performed. Reactor operation is permitted after a successful retest which demonstrates conformance with the acceptance criteria.

The containment isolation system is designed to minimize the leakage of radioactive materials through fluid lines penetrating the containment, in the event of LOCA or main steam line rupture, to a rate low enough to ensure that offsite dosage is below the limits specified in 10 CFR Part 100. 1

NRC GDC 52, 53, 54, 55, 56, and 57 are followed with respect to containment leakage rate testing. Closure of containment isolation valves will be accomplished by normal operation. However, systems that are required to maintain the plant in a safe shutdown condition during the test will be operable in their normal mode, and will not be vented. Systems that are normally water filled and operating under post-accident conditions will not be vented. 9

The status of each valved fluid line penetration during the containment integrated leakage-rate Type A test is shown in Table 6.2-23. 9

6.2.6.2 Containment Penetration Leakage Rate Test

Containment penetration leakage testing is in accordance with the requirements of 10 CFR Part 50, Appendix J, Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors. Test methods are in accordance with ANSI N45.4, Leakage-Rate Testing of Containment Structures for Nuclear Reactors, to the extent referenced in 10 CFR Part 50, Appendix J.

The leakage-rate tests, Type B, performed on the various types of penetrations are described as follows:

1. The equipment hatch, personnel airlock, emergency airlock, and fuel transfer tube are provided with covers sealed by double gaskets arranged so that the space between the gaskets can be pressurized. See Figure 3.8-7. The seal is tested by either pressurized air or nitrogen at Pa and measuring the rate of pressure loss or by pressurizing with a halogenated test gas to Pa and testing for leakage with a halide leak detector. The halide leak detection method is not used on stainless steel components.

2. The fuel transfer tube penetration consists of a sleeve embedded in the Containment wall and welded to the liner 6
through which the transfer tube passes. The sleeve is sealed to the transfer tube by two bellows expansion joints, one on each side of the penetration. See RESAR Figure 9.1-1 Fuel Transfer System and Figure 3.8-7.

   A test connection is provided so that the space between the transfer tube and the sleeve with connecting bellows can be pressurized to Pa. Leakage of the bellows or attachment welds is detected by measuring the rate of pressure loss.

3. The Containment recirculation sump penetrations consist of sleeves embedded in the Containment mat with the process pipe seal welded to the sleeve by a seal ring inside the Containment. The sleeve is welded to the Containment liner. Each valve isolation tank is sealed to the process pipe downstream of the isolation valve by bellows expansion joint (see Figure 6.2.27). All manways and flanges on the valve isolation tanks are provided with double o-ring seals to permit leakage testing by pressurizing the space between the

TABLE 6.2-18
(Sheet 1 of 3)

CONTAINMENT SPRAY SYSTEM

COMPONENT DESIGN PARAMETERS

Component		
Containment Spray Pumps		
Quantity	two	
Type	vertical centrifugal	
Design flow rate, gpm	4,500	9
Design TDH, ft	600	
Design pressure, psig	350	
Design temperature, F	300	
Refueling Water Storage Tank		
Quantity	one	
Capacity, gal	570,000	4
Design pressure, feet	Atmospheric	
Design temperature, F	200	

TABLE 6.2-18
(Sheet 2 of 3)

CONTAINMENT SPRAY SYSTEM

COMPONENT DESIGN PARAMETERS

| 9

Chemical Eductor

Quantity	two
Motive side fluid	borated water
Concentration, ppm of boron	2000
Design pressure, psig	325
Design temperature, F	300
Total flow, gpm	225

| 9

TABLE 6.2-18
(Sheet 3 of 3)

CONTAINMENT SPRAY SYSTEM

COMPONENT DESIGN PARAMETERS

Suction side fluid	sodium hydroxide solution	
Concentration	30 percent (by weight)	
Design pressure, psig	Hydraulic Head	
Design temperature, F	Ambient	
Total flow, gpm	85	9
<u>Spray Additive Tank</u>		
Quantity	one	
Capacity, gal	7,000	9
Concentration contents	sodium hydroxide 30 percent (by weight)	
Design pressure, psig	20	
Design temperature, F	150	
<u>Containment Spray Nozzle</u>		
Quantity per train	476	
Flow per nozzle at 40 psi, gpm	15.2	
Type	Spraco 1713A or equivalent spray nozzle with the same drop size distribution.	2

6.5.1.4 Tests and Inspection

Inspection and testing of the ESF atmosphere cleanup units are consistent with the inspection and test requirements for the non-ESF units. These requirements are described in subsection 9.4.1.4. The criteria for keeping occupational radiation exposures as low as reasonably achievable during replacement of filters and adsorbers is described in subsection 12.3.3.5. Equipment are both factory and inplace tested as per Regulatory Guide 1.52 positions C.3 and C.5. The maintenance procedures are in accordance with position C.4.

6.5.1.5 Instrumentation Requirements

Each ESF atmosphere cleanup unit is provided with instrumentation in accordance with position C.2.G of NRC Regulatory Guide 1.52. A pressure indicator connected across the filter train is provided to monitor the overall resistance of each cleanup unit. 4
Abnormal differential pressure will alarm in the control room to alert the operator. Local pressure indicators are provided to monitor the resistance of each individual filter bank. High differential pressure will indicate clogged or dirty filters. Each adsorber bed has a temperature-monitoring system. The system indicates bed temperature and actuates a high-temperature alarm in the control room in accordance with the temperatures listed in Table 6.5-1. The actions that are subsequently taken are also described in this table.

Flow elements are provided to measure the flow through each cleanup unit. Flow indicators are provided for local indication.

A pressure differential switch is located across each fan with a control room alarm for abnormal conditions. All fans are started manually, with automatic start of the standby fan. 4

Design details and the system logic are described in subsections 7.3.1 and 7.6.1.

1

6.5.1.6 Materials

Each ESF filter housing is of all-steel construction and welded; also brazed or bolted, or a combination of both, in accordance with the design requirements of ORNL-NSIC-65. Specific information relating to commercial name, quantity, and chemical composition of the materials used is provided in the Utility-Applicants SAR. HEPA filters and prefilters are fabricated of glass fiber; adsorbers are fabricated of activated charcoal. Ductwork will be of sheet metal (galvanized steel) construction. Redundant ESF atmosphere cleanup units are provided for the systems outlined in subsection 6.5.1.1 and are physically separated to ensure that any radiolytic or pyrolytic decomposition of the materials used in or on a particular filter system does not interfere with the safe operation of that system or any other ESF system.

6.5.2 Containment Spray System

The containment spray system has, in addition to its heat removal 1
capabilities, the ability to scrub fission product from the post accident atmosphere of containment and to minimize the release of radioactive iodine to the environment. This section describes the iodine removal capability of the containment spray system and the analysis of the radiological consequences of the LOCA is given in Subsection 15.6.5.3.

6.5.2.1 Design Bases

Following a loss of coolant accident, the release of radioactive iodine isotope (See Table 6.5-2) from the reactor containment will present a hazardous condition which will be alleviated by the containment spray system and will reduce the offsite doses well below the limits of 10 CFR Part 100. The sodium hydroxide solution is added to the borated spray water via a spray additive subsystem. Component sizing, layout, and the spray solution chemistry will be governed by the following principal criteria:

a. Volumetric containment coverage, with one out of two redundant spray trains in operation, must be maximum.

b. The spray fall height above the operating floor used in the analysis was conservatively taken as the difference in elevation between the lowest ring header of the containment dome and the operation floor. This distance is 140 feet. 9

1

c. The spray system will deliver the design flow rate of 4500 GPM, to one train of spray nozzles, despite a single failure in the containment spray system. 1 9

1

d. The system will be capable of permanent removal of iodine from the containment atmosphere by absorption into the spray droplets and retention in the containment recirculation sump. 9

e. Components of the containment spray system as well as the spray additive subsystem will be designed to meet safety Class 2 and seismic Category I requirements.

6.5.2.2 System Design (for Fission Product Removal) 1

One of the containment spray system functions is fission product iodine removal from the containment atmosphere during the initial mode (injection phase) of system operation. This phase is initiated automatically by a containment pressure HI-3 signal, by manual action or by safety injection signal coincident with a HI containment temperature signal. Generation of the HI-3 signal is described in subsection 7.3.1.1.a. These signals will automatically open the discharge valves to the spray headers 9 which can also be opened manually from the control room. Prior to the containment spray actuation signal, the containment spray pumps will have received a signal to start from the safety injection "S" signal.

At this time each containment spray pump draws water from the Refueling Water Storage Tank. The quantity of water in the RWST is sufficient enough to provide water to both the containment spray system and emergency core cooling system. Simultaneously with the start of the injection phase the valves of the spray additive tank discharge open to allow the flow of NaOH, which is 1 drawn from the tank and is introduced by eductors into containment spray pump suction pipe.

The spray additive tank outlet valves are closed during normal operation to prevent mixing of the NaOH with boric acid in the RWST. The RWST is adequately vented to permit rapid drawdown. Nitrogen gas cover inside the spray additive tank is provided by the nitrogen supply to ensure an adequate pressure inside the tank. Approximately 5 percent of each containment spray pump flow is branched through the pump bypass eductors, to draw sodium hydroxide from the spray additive tank and this flow is returned back to the pump suction line.

A 30 percent by weight solution of sodium hydroxide flow will be 1
calitrated at 85 gpm per eductor to maintain the alkalinity of 9
the spray solution at the design pH range of 9.3-10.0. This 1

alkalinity will be maintained in this range during the entire injection phase.

The containment spray additive subsystem is composed of one spray additive tank, two chemical eductors, connecting piping, valves, and related instrumentation. The containment spray system is capable of delivering spray water to the containment atmosphere in sufficient quantity and with an optimum average droplet diameter to ensure adequate iodine removal from the containment atmosphere. The spray system is comprised of two independent trains each containing one spray pump, piping, spray headers, valving, spray nozzles and associated instrumentation. There are four ring headers per train, physically located at different elevations at the uppermost part and supported from the containment dome, and three auxiliary headers located at lower elevations to maximize sprayed volume coverage. All containment spray headers are equipped with nozzles each spraying horizontally, vertically downward, upward at 45 degrees and 1
downward at 45 degrees. This arrangement provides a maximum volume spray coverage even if one of the containment spray trains fails to operate. The number of spray nozzles is based on sprayed volumes required for each containment region and their respective flow rates as listed in Table 6.5-3. The nozzles are of a hollow type with 3/8 inch diameter orifice and designed to operate at a pressure drop of 40 psi. These nozzles produce droplets with a mean diameter less than 1000 microns at 40 psi differential pressure.

The nozzle spacing and orientation provides maximum coverage of containment volume. The physical arrangement is shown in Figure 6.5-2. The histogram of the observed dropsize frequency is based on tests performed by Spray Engineering Company's laboratory of the Spray Engineering Company's spray nozzle type 1713a as shown in Figure 6.5-3. 9

In case of a LOCA and loss of offsite power, the maximum time to close containment spray pump breakers, including 10 seconds for a 1
diesel generator to come up to speed and voltage, will be 20 seconds after the safety injection signal actuation. The safety injection signal is actuated within the first second following the accident. The containment analysis will use the value of 51.3 seconds for delivery through all spray nozzles of at least one train at rated flow due to the delay outlined below, 9
after the double-ended reactor coolant pump suction pipe guillotine break and loss of offsite power.

1

This delay includes:

a. Within the first second after the break, the safety injection, "S" signal, is actuated.

b. Seven seconds after the break, the "P" signal is activated at 20 psig containment pressure.

c. Eleven seconds after the break, the opening of the containment spray pump isolation valves is initiated.

d. Twenty-one seconds after the break the containment spray pump will be started, and the containment spray pump isolation 9
valves will be fully open.

e. Twenty-six seconds after the break, the containment spray pump will be at full speed.

Between the 26th and 51st second, water will fill the CS piping and full flow at the furthermost nozzle will be achieved.

Duration of the injection phase of the containment spray flow depends on the total flow drawn from the RWST at the flow rates required of the ECCS and containment spray system. This duration is given in Table 6.1-6 for all modes of operation, i.e., combinations of maximum or minimum ECCS operation with one or two train containment spray system operation.

The suction of the containment spray pump will be automatically switched to the recirculation sumps when the RWST supply is 1
nearly exhausted, that is, when its contents are reduced to 70,000 gallons. The automatic recirculation signal, described in subsection 7.3.1.1.b, will start the recirculation phase of the containment spray system, opening the motor operated valves in the suction lines from the containment recirculation sumps, where the injection water, reactor coolant and accumulator spillage
have collected. After the start of the recirculation phase, the 9
motor operated valves from the RWST will be automatically closed, isolating the RWST from the containment spray pumps. Water from the sumps will then be sprayed into the containment. The sumps are designed to promote continuous mixing of ECC and CS systems water, thus providing sufficient heat removal capacity to maintain containment pressure below the design value for all cases of postulated loss-of-coolant occurrences. Failure to switch a spray train at the RWST low level will be automatically detected by the low-low RWST water level which will be annunciated in the control room. At this time the control room

operator will manually switch the affected containment spray train to start the recirculation phase. This phase of operation will continue as long as necessary to ensure containment 9 depressurization.

The regions of the containment covered by the spray and their respective volumes are listed in Table 6.5-3. These sprayed volumes are based on the free volume of each region from which the equipment and wall volumes are subtracted. Figure 6.5-3 is a schematic of the containment that shows the locations of the 1
spray nozzles, and spray regions, labeled A,B,C,D. The containment spray characteristics of each region inside the containment are described in Table 6.5-3.

The regions A,B,C,D consist of the following:

1) Region A

The volume of 2,771,998 ft³ directly covered by spray 9 4
includes the volumes:

- above operating floor
- above refueling cavity
- refueling cavity 1
- pressurizer compartment
- reactor vessel head storage area
- steam generators compartments

2) Region B

The volume of 93,945 ft³ covered by spray represents 4
45 percent of the total free volume between:

- floor between elevations 171'-11" and 150'-11" 1

3) Region C

The volume of 37,000 ft³ covered by spray represents 4
16 percent of the total free volume between:

- floors el. 150'-11" and 124'-6"

1

4) Region D 1

The volume of 60,800 ft³ covered by spray represents 24 percent of the total free volume between: 4

- floor elevations 124'-6" and 90'-6"

5) The volume not covered by spray includes the following:

- cavity beneath reactor vessel 1

- elevator

- reactor coolant drain collection tank, pumps, and heat exchanger rooms 4

- incore instrumentation room

6.5.2.3 Design Evaluation 1

The containment spray additive subsystem uses state-of-the-art technology for absorbing radioactive iodine from the containment 4
atmosphere. A favorable alkalinity level is established by the addition of sodium hydroxide solution to the spray water. The alkalinity increases the solubility of iodine so that the rate of 1
iodine absorption is limited mainly by the mass transfer rate through the gas film surrounding the spray water droplets. Furthermore, the alakalinity level is such that it prevents the dissolved iodine from escaping from the containment recirculation 9
sump water.

Radioiodine, in its various forms, is the fission product of primary concern in the evaluation of a LOCA. The major benefit of the containment spray is its capacity to absorb elemental iodine from the containment atmosphere. To enhance the iodine-absorption capacity of the spray, the spray solution is adjusted to an alkaline pH which promotes iodine hydrolysis to 1
nonvolatile forms.

According to the known behavior of elemental iodine in highly dilute solutions, the hydrolysis reaction

$$I_2 + OH^- \rightleftharpoons HIO + I^-$$

is nearly completed at ph>8. The iodine form is highly soluble, and HIO readily undergoes additional reactions to form iodate.

The overall reaction is

$$3I_2 + 3H_2O \rightleftharpoons 5HI + HIO_3$$

The basic criteria used for design of the spray additive subsystem are explained as follows: 1

a. Alkalinity level of the spray solution during the injection phase is pH=10.5 for all modes of operation (fully effective spray and minimum safeguard operation).

b. Volume of NaOH drawn from the spray additive tank during the injection phase is such that the final sump alkalinity is pH=8.6 (fully effective spray and minimum ECCS operation).

The containment sump solution pH for each operational mode is given in Table 6.1-6, taking into consideration a single failure analysis. The single failure analysis for the spray additive subsystem is shown in Table 6.5-4.

To determine the containment recirculation sump solution pH, all sources of borated water such as the RCS accumulators, the boron injection, the refueling water storage tank, and the weight of NaOH which would be lost in the containment "dead" volumes are taken into consideration. The "dead" volumes consist of the reactor cavity up to RCS piping, containment (leak detection) sumps and areas below the recirculation sump as incore instrumentation and RC drain tank rooms. Significant quantities 9
of spray and injection water will not be trapped in SG subcompartments because vent paths allow for drainage. Escape of the post-LOCA water from the containment sump into a low activity waste collection tank will be precluded by drain isolation valves and by deenergizing the sump pumps after the accident.

The mixing of the containment spray solution with the spilled water is considered complete in the containment sumps. Material compatibility is discussed in subsection 6.5.2.6.

The analytical method used for determining the effectiveness of the sprays is taken from WASH-1329, "A Review of Mathematical Models For Predicting Spray Removal of Fission Products in Reactor Containment Vessels"(1) as recommended in SRP 6.5.2. The assumptions used are explained below:

1) The removal mechanisms are assumed to be first order and independent of time and iodine concentration. SRP 6.5.2. III.4.b states that iodine removal is to be assumed to be first order. To be independent of iodine concentration, the physical properties such as density, viscosity, and diffusivity as well as the partition factor, H, must be independent of iodine concentration. At low iodine concentrations, the physical properties are known to be independent of iodine concentration, however H is not (1). 4

4

6.5.2.4 Tests and Inspections

The containment spray system will be designed to permit periodic testing to demonstrate system performance readiness. Each component of the system shall be subjected to preoperational, and operational testing and inspections as described in the following paragraphs. In addition to routine inspection, periodic visual inspections will be 1
performed to check for corrosion and surface cracks in welds.

a. Preoperational Inspection and Testing

Containment spray components will be inspected and tested in accordance with applicable codes as described in Section 3.2.

The environmental conditions for qualification tests are shown in Tables 3.11-3 and 3.11-4 and Figures 3.11-1 and 3.11-2. 9

The containment spray pumps will be tested after fabrication and after installation to ensure full operability and required performance. The performance curves and NPSH requirements will be supplied by shop tests to confirm pump design characteristics. After installation the pumps will be tested using refueling water by recirculating back to the RWST. This test will also check and verify 1
the operability of the recirculation flow control valves.

The spray additive eductors will be tested and calibrated after fabrication for their performance using fluid comparable to the spray additive solution. After installation, the spray additive system will be tested using refueling water as the test fluid. For evaluation of test data results, a correlation factor of 1.34 will be used (ratio of specific gravity of the NaOH solution to borated water).

To verify maximum droplet mean diameter for spray nozzles, performance data will be provided after the manufacturer's shoptest.

The spray nozzles will not be tested "in situ" with water. However, a containment spray system full flow ring header test was performed at Zion Nuclear Power Plants - Units 1 and 2 (Docket Numbers 50-295 and 50-304). This test demonstrated that flow passing through the system was as designed, that there was no discernable movement in the ring headers when subjected to spray flow forces, and that the containment coverage was as predicted. After the spray headers are installed, air under pressure will be passed through test connections in order to check that the spray nozzles and ring headers are free of obstructions and are not clogged.

b. Operational Testing 1

Routine testing will be performed periodically to verify the operability of active containment spray system components.

1) The spray additive system will be tested using refueling water as a test fluid. The test line from the RWST to the spray additive discharge line, upstream of the spray additive flow measuring element will be opened, along with the full flow test line from the discharge of the containment spray pumps which is recirculated back to the RWST. For evaluation of test data, the correlation factor is 1.34 (ratio of specific gravity of the NaOH solution and borated water).

2) Sequencing of valves and pumps will be tested by
shutting the manual valve on the containment spray line
inside the containment and the manual valve on the chemical 9
additive supply line and triggering a simulated actuation
signal. All automatic valves and the pumps will be checked
for proper sequencing.

3) Each pump will be run at full flow with the flow directed back to the RWST.

4) Spray nozzles will be tested by compressed air using test connections in the containment spray lines to check the spray nozzles for flow. Operators will confirm that all nozzles are free of obstructions. 1

5) The RWST water is sampled periodically to monitor water chemistry. Provisions are made so that the water can be purified by circulating it through the purification loop of the spent fuel pool cooling and purification system.

6) To maintain an adequate supply and proper concentration 1
of NaOH in the spray additive tank, both the fluid level and
the NaOH concentration will be checked usually once a month
and once a year, respectively.

7) Means will be provided for intermittent detection of
RWST and CSS particulate material which could plug the spray 4
nozzles. The testing will be performed periodically using
the test line returning water to the RWST. The discharge
into the tank will be divided into two fractions, one for
the major portion of the flow and the other to pass a small
quantity of water through test nozzles, identical with the
containment spray nozzles. This assures that there is no 9
particulate material in the RWST and CSS. The flow rate
through the test nozzles will be monitored and compared to
the previously established flow rate obtained with open
nozzles.

6.5.2.5 Instrumentation Requirements 1

a. Containment pressure transmitters and temperature sensors
are used for automatic actuation of the containment spray system
(refer to Chapter 7). Unless manually stopped, the system will
operate indefinitely. 9

The actuation of system components is described in subsection 7.3.1.1,b and shown in the logic diagrams (Figure 7.3-1).

b. Four RWST level channels will be provided and used for ECCS
and containment spray system operation (refer to Chapter 7 of 6
RESAR-414).

Two water level indicator channels will be provided for each containment sump. Both will be indicated in the control room to inform the control room operator on the water level stability in the containment sump during the recirculation phase.

1

Redundant level transmitters are provided for the spray additive tank with a low-level alarm and indication in the control room. The low level alarm will inform the operator to check the tank isolation valves and to inspect the system for leaktightness.

c. The containment spray pump discharge pressures will be indicated and recorded in the control room.

A pressure indicator is provided at the eductor suction. Instrumentation is provided to maintain and indicate the desired nitrogen blanket pressure in the spray additive tank.

d. Temperature of the RWST will be indicated in the control room. 1

e. A flow instrumentation monitor is located on the spray additive line upstream of the eductor, with indication in the control room.

TABLE 6.5-3

CONTAINMENT SPRAY CHARACTERISTICS 6

Parameters	Sprayed Regions				Unsprayed Region	Total	
	A	B	C	D	E		
Total Volume-ft³	2,771,998	208,766	231,300	253,339	61,449	3,526,852	9
Sprayed Containment Volume-ft³	2,771,998	93,945	37,000	60,800	0	2,463,743	6 9
Unsprayed Containment Volume-ft³	0	114,821	194,300	192,539	61,449	563,109	6
Spray Drops Fall Height -ft	140	17	23	28	-		9
Spray System Flow Rate-gpm	3,200	650	230	420	-	4,500	6 9
Number of Nozzles per Train	338	68	23	47	-	476	

6

TABLE 6.5-4
(Sheet 1 of 2)

SINGLE FAILURE ANALYSIS-CONTAINMENT SPRAY SYSTEM

Component	Malfunction	Comment and Consequences	
1. Containment Spray Pumps	Fail to start, Pump - Pump casing rupture	One 100% pump per train provided. Operation of one train required.	
2. deleted			8
3. Spray Nozzles	Clogged	Adequate number of nozzles per train ensures effective spray coverage of the containment.	
4. Auto Containment Spray Pump Discharge Valve opened on 2/4 HI-3 signal	Fails to open	Two valves provided. Operation of one is required.	
5. Containment Spray Pump Suction Isolation Valve	Fails to open	One valve per train provided. Operation of one train is required.	
6. Recirculation Sump Isolation Valve	Clogged	One Sump per train provided. One train has to remain operable.	8
7. Containment Spray Piping	Ruptures	Two redundant trains are provided for full heat removal.	
8. Valve on Spray additive Tank Outlet	Fails to open	Redundant valve will open	

TABLE 6.5-4
(Sheet 2 of 2)

SINGLE FAILURE ANALYSIS-CONTAINMENT SPRAY SYSTEM

Component	Malfunction	Comment and Consequences
9. Automatic electric and instrumentation trains to actuate ESF equipment	One train fails to operate	There are redundant outputs from the Protection cabinets to each train. One train has to remain operable.
10. Recirculation sump isolation valve	Fails to open	Two valves provided. Operation of one is required.

TABLE 6.5-5

CONTAINMENT SPRAY SYSTEM MATERIALS

Component	Quantity	Material	
Spray Additive Tank	1	SA-240 Type 304	4
Recirculation Sump Screen	2	ASTM A-580, Type 304	4
Spray Pump			4
Casing	2	SA-351 CF8M TP	9
Shaft		SA-182 Gr. 316	4
Impeller		SA-351 CF8M	
Chemical Eductor	2	SA-182 Gr. 304	9
Valves 2 1/2" and larger	31	SA-351 CF8	4
Valves 2" and smaller	60	SA-182 Type 316	
Piping	-	SA-312 Type TP 304 or SA-358 Class 1	9
Refueling Water Storage Tank	1	SA-240 Type 304L	
Containment Spray Nozzles		Austenitic Stainless Steel	
Stop Valves (Spray Additive Tank Discharge)	4	SA-351 CF8	4
Valve Isolation Tank	2	SA-516 Gr. 70	9

All materials conform to ASME Section III Code Class 2 and are subject to manufacturers standards.

TABLE 6.5-6

PRIMARY CONTAINMENT OPERATION
FOLLOWING A DESIGN BASIS ACCIDENT

General

Type of Structure	-	Reinforced Concrete
Internal Fission Product Removal System	-	Containment Spray System
Primary Containment Free Volume (ft^3)	-	3,526,852 4 9

Time Dependent Parameters

	Conservative
Leak Rate of Primary Containment (% per day)	0.10 4
Leakage Fractions To Volume Outside the Containment (%)	100 4
Effectiveness of Fission Product Removal Systems: Spray (iodine removal coefficient)	
Elemental	$33.5\ hr^{-1}$* 4
Particulate	$1.30\ hr^{-1}$

*For added conservatism 10 hr^{-1} is used in all accident analyses

TABLE 6.5-7

IODINE SPRAY REMOVAL COEFFICIENT (hr^{-1})

6

Elemental Removal Coefficient

Temperature (C)	Region A	Region B	Region C	Region D	
100	30.2	169	161	177	
110	29.7	169	161	177	9
120	28.8	168	160	175	
130	27.8	167	159	173	
140	26.6	165	157	170	

Particulate Removal Coefficient

6

Temperature (C)	Region A	Region B	Region C	Region D	
100	2.37	2.10	2.53	3.26	
110	2.27	2.09	2.52	3.23	9
120	2.15	2.09	2.57	3.21	
130	2.01	2.08	2.50	3.18	
140	1.80	2.07	2.48	3.14	

7. INSTRUMENTATION AND CONTROLS

TABLES

7. INSTRUMENTATION AND CONTROLS

FIGURES

9

d. Component Cooling Water System 3

This system is similar to the one used on CPSES Units 1 and 2. 1
The differences are as follows:

1) CPSES Units 1 and 2 provide two 100-percent-capacity pumps for each unit. Some of the primary plant cooling is provided by the CCWS and the rest is by the service water system.

2) The GIBBSSAR plant provides four 100-percent-capacity pumps and all the primary plant cooling is done by the CCWS, except for the emergency diesel generators and the CVCS chiller unit, which are cooled by the service water system. At plantsites with poor water quality, all cooling is done by the CCWS. (See Section 9.2.)

e. Service Water System 3

This system is similar to the service water system in CPSES Units 1 and 2. CPSES Units 1 and 2 provide two 100-percent-capacity pumps for each unit which take their suction from the safe shutdown impoundment (SSI). GIBBSSAR provides four 100-percent-capacity pumps for this system. Equipment is designed and built to the specifications of G&H.

f. Standby Power Supply System 3

This system is similar to CPSES Units 1 and 2. Equipment is designed and built to the specifications of G&H.

g. Control Room Air-Conditioning Unit 3

This system is similar to the CPSES Units 1 and 2 control system. The system is designed and built to the specifications of G&H.

h. Auxiliary Feedwater System 3

This system is similar to CPSES Units 1 and 2. Equipment is designed and built to the specifications of G&H. All of the previously mentioned systems are described in subsection 7.3.1.1. The following safety-related systems are described in Section 9.4 and are in G&H's range of responsibility. 9

i. Uncontrolled Access Area Ventilation 3

This system, used in CPSES Units 1 and 2, is not safety-related. The cooling of the equipment is performed by the use of safety-related auxiliary cooling units. In GIBBSSAR, the system is safety-related and provides ventilation to the safety-related switchgear rooms, battery rooms, inverters, and electrical penetration areas containing safety-related equipment. The system contains two 50-percent-capacity fans for each separate fans emergency safeguard electrical bus. The system is designed and built to the specifications of G&H.

j. Controlled Access Area Ventilation 3

This system is similar to the system used in CPSES Units 1 and 2 for the auxiliary building, safeguards building, and fuel-handling ventilation systems. 9

k. Diesel Generator Ventilation 3

This system is the same as CPSES Units 1 and 2. The system is designed by, and built to the specifications of G&H.

7.1.2 Identification of Safety Criteria

7.1.2.1 The following design bases, criteria, Regulatory Guides, and standards are implemented in the design of the systems listed in subsection 7.1.1, and are presented as supplementary information to subsection 7.1.2 of the NSSS SSAR. The degree of compliance with each of these safety criteria is as outlined below. 1

a. <u>NRC Regulatory Guide 1.11, "Instrument Lines Penetrating Primary Reactor Containment"</u> 1

The only instrument lines that penetrate the Primary Reactor Containment are for the reactor containment pressure transmitters, and these are designed in strict conformance with 9
subsection 6.2.4.1.

The following paragraph numbers correspond to like numbered paragraphs in Regulatory Guide 1.11, and are presented to indicate the degree of compliance to this criteria.

C.1a There are four separate and independent pressure sensing lines, each of which can be tested individually.

C.1b Sensing lines are 0.25" O.D., 316 SS with 304 SS flexarmor and are leaktight, hence, no makeup or offsite doses are expected.

C.1c The reactor containment pressure sensing lines do not have isolation valves. Isolation is provided by means of double sealed bellows 1
connected to a fluid-filled tube, thus protecting (in the case of line break inside or outside of containment) against leakage of the containment atmosphere.

C.1d Instrument lines are conservatively designed and of a quality at least equivalent to the containment and subject to strict quality control and regular inspections to assure integrity. Instrument lines will be located and protected so as to minimize the possibility of their being damaged accidentally and also to permit periodic visual inservice inspection, particularly outside containment. They will be protected or separated to prevent failure of one line from inducing failure of any other line.

C.1e As per response in C.1c, the arrangement will not restrict an adequate response time of the connected instrumentation to an unacceptable degree.

C.2 The reactor containment pressure sensing lines are the only instrument lines penetrating reactor containment.

b. NRC Regulatory Guide 1.22, "Periodic Testing of Protection System Actuation Functions"

The plant protection system is supplied by the NSSS vendor, which supplies outputs to actuate BOP safety-related equipment. The NSSS vendor periodically tests the plant protection system, and supplies output contacts to test the BOP actuated equipment devices.

The testing of the BOB ESF systems is in compliance with the requirements of NRC Regulatory Guide 1.22. The method of compliance utilized for the various ESF and ESF supporting systems is discussed in subsection 7.3.2 1

c. NRC Regulatory Guide 1.29 "Seismic Design Classification"

The following paragraph numbers correspond to like numbered paragraphs in Regulatory Guide 1.29, and are presented to indicate the degree of compliance to this criteria. Additional information concerning seismic criteria can be found in Chapter 3.

C.1 The instrumentation and control functions of each of the systems listed in subsection 7.1.1, including their foundations and supports, and the structures in which they are located are classified as seismic Category I and are designed to withstand the effects of the SSE and remain functional.

C.2 The non-safety-related, systems or components whose failure would unacceptably reduce the

The redundancy requirement for the isolation of the
lines penetrating the containment is satisfied by having
two isolation valves in series. In this case, the power
supply for the valves comes from separate and 6
independent buses, i.e., one valve is powered from the
Train A bus, and the other valve is powered from the
Train B Bus.

4) Control Room Indication

Each remotely operated containment isolation valve is provided with limit switches to give control room indication of valve status.

b. Containment Spray System

The containment spray system is outlined in detail in
subsection 6.5.2. 1

1) Actuation of System Components

The containment spray system consists of two separate
and independent full-capacity safety-related loops, each
capable of fulfilling the design requirements. The 6
system is initiated automatically by a HI-3 signal by
manual action or by safety injection signal coincident
with a Hi containment temperature signal. Generation of 9
this HI-3 signal is described in subsection 7.3.1.1,a.

Manual initiation of containment spray is accomplished by actuating either of two sets of switches (two switches per set.) Both switches in a set must be actuated to obtain a manually initiated spray signal. The sets are wired to meet separation and single-failure requirements of IEEE 279. Simultaneous operation of two switches is desirable to prevent inadvertent spray actuation.

Prior to the containment spray actuation signal, the containment spray pumps have been started by safety injection signal S.

9

Receipt of the HI-3 or safety injection signal concident with a Hi containment temperature signal initiates the following automatic action: the opening of the spray header discharge valves; and the opening of the chemical additive tank stop valves.

The changeover from the injection mode to the recirculation mode of operation for the containment spray system is automatically initiated on a

two-out-of-four refueling water storage tank low-low level in conjunction with a HI-3 containment pressure signal or safety injection signal coincident with a containment Hi temperature signal. 9

The complete description of the two out of four protection channel logic for the automatic changeover to recirculation mode is provided in RESAR 414 Section 6.3.2.2. 6

This automatic initiation of the containment spray recirculation mode results in the following actions:

a) Opening the containment spray sump recirculation valves

b) Closing the containment spray pump suction valves from the RWST

The system changeover may also be manually initiated from the control room. 9

The containment sump isolation valves are interlocked to prevent their being opened by operator action from the main control board unless the corresponding RWST isolation valves are closed. 6

2) Control of System Operation

The containment spray system is designed with on-off controls. Once the system is actuated, the pumps operate with constant flow. 9

3) Monitoring of System Operation

The containment spray system is provided with control room display instrumentation as described in Table 7.5-1. 1 In addition, RWST level is indicated and alarmed in the control room as provided in Table 7.5-1 of RESSAR 414. Local indication is provided for chemical additive tank level and pressure, chemical additive flow and pressure, containment spray pump 6

discharge pressure and recirculation to the RWST flow. Additional control room alarms are provided for refueling water storage tank low temperature and chemical additive tank high/low pressure. 6

Each power-operated valve is provided with position indicating lights in the control room.

The following automatic operation occurs upon initiation of an S signal (Figure 7.2-1 of RESAR-414 shows the logic for initiation of safeguards actuation signals). The two CCWS pumps in auto start; unless already running, the pumps selected for standby operation by the pump control switch do not start.

The following automatic operations occur upon initiation of a containment isolation phase B signal: 1

a) The valves on the interconnecting header between the two safety-related loops close.

b) The non-safety-related loop isolation valves close.

c) The CCWS containment isolation valves close.

The two safety-related loops can be manually isolated from each other at any time from the control room. The RHR heat exchanger discharge valves open automatically on initiation of the containment spray recirculation phase.

The reactor coolant pumps thermal barrier discharge header is provided with an excess flow check valve inside the containment to limit in-leakage of reactor coolant in the event of a thermal barrier rupture.

The CCWS header to the ventilation chillers is provided with a high-flow monitor to isolate the chillers in the event of a break in the non-nuclear-safety-related piping.

The CCWS surge tank vent valve closes automatically on a high-radiation signal from any one of the loops.

2) Control of System Operation

The CCWS is designed to operate without throttling valves.

The CCWS surge tank level is used to detect system leakage. The control system for each half of the partitioned tank consists of the following:

a) Level indication local and control room

b) Level recording

c) High-high/low-low alarms

d) Automatic makeup from the demineralized water storage tank on low level

e) Automatic makeup termination on high-level 6

f) Manual makeup from the Fire Protection System 9

3) Monitoring of System Operation

The CCWS is provided with safety-related control room 3
display instrumentation as described in Table 7.5-1. In addition, each heat exchanger outside containment is supplied with local temperature indication. Sufficient local flow indication is provided to allow flow balancing of the system. Each flow indicator has a low-flow alarm contact to alert the operator to a system malfunction. Flow indication and alarm is provided in the control room for containment spray and RHP heat 3
exchangers. In addition the CCWS return line temperature from each RCP lube oil cooler is indicated and alarmed in the main control room.

Each power-operated valve is supplied with a control switch and indicating lights in the control room.

Radiation monitors are provided with readout in the control room for each of the two system loops.

4) Sequencing

Upon loss of offsite power, one pump from each train is automatically loaded onto the emergency diesel generators according to the sequence shown in Table 8.3-1.

5) Redundancy

Separate switches and actuation circuitry is provided for redundant components which are physically and electrically separated from one another.

3) Monitoring of System Operation

The auxiliary feedwater system is provided with display instrumentation, both in the control room and on the hot shutdown panel as follows: 1

a) Steam generator level

b) Auxiliary feedwater flow to each steam generator

c) Pump flow for each auxiliary feedwater pump

d) Pump discharge pressure for each auxiliary feedwater pump

e) Pump suction pressure for each auxiliary feedwater pump

f) Auxiliary feedwater storage tank level

4) Sequencing

Upon loss of offsite power, each motor-driven pump is automatically loaded onto its repsective emergency diesel generators according to the sequence shown in subsectin 8.3-1.

5) Redundancy

Separate switches and actuation circuitry are provided for redundant components which are physically and electrically separated from one another.

7.3.1.2 Design Basis Information

Preliminary logic and instrument diagrams are shown on Figure 7.3-1. Figure 7.3-2 shows the location of the ESF instruments. 1
9

The following bases are established as specified in IEEE 279-1971:

a. Basis 1

The generating station conditions which require protective action are given in RESAR-414, subsection 7.3.1.2.

b. Basis 2

The generating station variables that are required for monitoring in order to provide protective action are given in RESAR-414, subsection 7.3.1.2.

c. Basis 3

No spatially dependent variables are used for engineered safety features actuation. 1

d. Bases 4, 5, and 6

The normal operating limits, pretrip alarm setpoints, and alarm sets are designed so that they perform in an adverse environment during normal, abnormal, and accident circumstances.

e. Bases 8 and 9

An actuation analysis is provided in RESAR-414, subsection 7.3.1.2, under the same headings.

7.3.1.3 Final System Drawings

Final system drawings will be provided at the FDR.

2

9.2 Water Systems

This Section provides a discussion of the following auxiliary water systems associated with the plant:

a. Service Water System (subsection 9.2.1)

b. Component Cooling Water System (subsection 9.2.2)

c. Demineralized Makeup Water (subsection 9.2.3)

d. Condensate Storage Facilities (subsection 9.2.6)

e. Plant Ventilation Chilled Water System (subsection 9.2.8)

f. Ventilation Safety Features Chilled Water System (subsection 9.2.9)

The Potable and Sanitary Water System (subsection 9.2.4), the Ultimate Heat Sink (subsection 9.2.5), and the Water Treatment System (subsection 9.2.7) will be described in the Utility-Applicant's SAR.

9.2.1 Station Service Water System

9.2.1.1 Design Bases

The service water system removes heat from the component cooli
water heat exchangers and, depending on the quality of site water
available, certain other plant components. The service water
system also acts as an alternate safety class water source to the
auxiliary feedwater system, which is described in
subsection 10.4.9. and an alternate NNS Seismic Category I water
source to the fire protection system. The service water system
supplies cooling water to meet the cooling requirements listed in
Table 9.2-1 and Table 9.2-2 during normal operation, shutdown, 9
and during and after a postulated accident or loss of offsite
power.

The choice of the service water system (once-through or closed
cycle) is a function of the available ultimate heat sink
(subsection 9.2.5) which is site-related, and will be presented
in the Utility-Applicant's SAR. Freeze icing and other adverse
environmental conditions protection which is site-related, will 6
be presented in the Utility-Applicant's SAR. See Table 9.2-5.
For the purpose of this document, however, it is assumed that an

ultimate heat sink is available and meets the interface requirements described in this Section. The service water interfaces with the ultimate heat sink at the service water pump inlet and at the service water discharge tunnel. 6

The service water system is designed to accommodate a range of inlet water design temperatures, i.e., 85 F, 95 F, and 100 F. The service water design flow rate is established for the most stringent operating conditions. The component cooling water heat exchangers are resized to maintain the same heat exchange capacity over the whole temperature range with a constant service water flow rate. The service water system design parameters presented in Table 9.2-3 are based on the previously mentioned criteria and on cooling the component cooling water heat exchangers and emergency diesel generators,which are required to operate after a LOCA, and the nonessential CVCS chiller package. However, for those sites where water quality is unacceptable, the service water system cools only the component cooling water heat exchangers. Service water system design parameters presented in Table 9.2-3 will be ammended to reflect the different flow conditions.

The service water system functions during normal operation and during and after a postulated accident or loss of offsite power. 9
Equipment required for safe shutdown is included on two identical redundant loops, the essential cooling loops. Flow in each essential loop is supplied by pumps powered from the emergency buses. Separate and independent emergency diesel generators supply power in the event of loss of primary and alternate offsite power. The onsite emergency power system is described in Section 8.3. The two essential loops are physically separated from each other and can be automatically or manually isolated. The CVCS chiller unit is cooled on a nonessential loop, which can be automatically or manually isolated from the two essential loops.

The two essential service water loops are designated Safety Class 3 and in accordance with the ASME B&PV Code, Section III. The system is Seismic Category I and is protected against the effects of a tornado.

9.2.1.2 System Description

The service water system is shown in Figure 9.2-1, and consists of two separate and independent, full-capacity essential loops and one nonessential loop. Each of the essential loops is equipped with two 100-percent-capacity service water pumps which feed one component cooling water heat exchanger and one emergency diesel generator. The nonessential loop, which contains the CVCS chiller unit, can be supplied by the pumps of either essential loop supply to the fire protection system is provided 9
from the discharge of each loop to the ultimate heat sink.

Under normal operation, a single service water pump supplying water to a component cooling water heat exchanger, emergency diesel generator of the same essential loop, and to the CVCS chiller unit on the nonessential loop is adequate for normal plant operation. Should the operating service water pump trip, the second service water pump in the operating essential loop automatically starts. In the unlikely event of a fault occurring in the operating essential loop, instrumentation logic is provided to automatically transfer operation to the other essential loop. If system operation is transferred from one essential loop to the other, feed to the nonessential loop is realigned to the operating essential loop. In the event that one service water pump is taken out of service for maintenance, the second full-capacity pump in the same essential loop is available for service. 9 9

For normal cooldown, the service water system uses two service water pumps (one from each essential loop) to supply both component cooling water heat exchangers, emergency diesel generators, and the CVCS chiller unit. A slower but acceptable cooldown rate may also be accomplished with only one service water pump supplying water to one component cooling water heat exchanger, an emergency diesel generator, and to the CVCS chiller unit.

Under accident conditions on receipt of an S signal, a pump in the second essential loop is started so that cooling water is supplied to both component cooling water heat exchangers and both emergency diesel generators. Upon receipt of the containment isolation signal, Phase B, the nonessential loop is automatically isolated from the essential loops. Although only one essential loop is required to mitigate the consequence of an accident, cooling water continues to be supplied to both essential loops. A single failure of any component does not prevent the service water system from supplying water to one essential loop, as described in Table 9.2-4.

Chemical addition to the service water to protect system components against corrosion depends on the water quality, the components to be cooled, and the nature of the service water system cycle. Corrosion protection of the service water system is site-related and will be discussed in the Utility-Applicant's SAR. The effects of water level, sedimentation, and other environmental related effects are site-related and will also be discussed in the Utility-Applicant's SAR.

Flow indication is provided downstream of each of the components cooled by the service water system to detect abnormalities in the system flow rates. Abnormal flow conditions are annunciated in the control room. The detection of leakage through the component cooling water heat exchangers to the CCWS is discussed in subsection 9.2.2.2. Although no radiation contamination of the service water system is anticipated, a radiation monitoring system is provided to ensure that any contamination will be detected.

9.2.1.3 Safety Evaluation

The service water system is made up of two full-capacity essential loops and one nonessential loop. During emergency operation, the nonessential loop is automatically isolated from the essential loops. The two essential loops are separated from each other by two remotely operated valves in series. The essential loops are redundant in that the component cooling water heat exchanger and emergency diesel generator supplied with cooling water by one loop are sufficient to perform the minimum required safeguard function. Failure of the nonessential cooling loop has no adverse affect on the capability to safely shutdown the plant or to maintain the plant in a safe shutdown condition.

The performance of all components is monitored from the control room. Low flow, low pressure, high temperature, and high radiation level, all of which are indicative of system malfunction, are annunciated in the control room. Radioactive contamination of the service water system is not expected; however, a radiation monitoring system is provided to ensure that any contamination is detected. The radiation monitoring system is described in Section 11.5

The essential service water loops of the system are designated Seismic Category I and Safety Class 3. The essential plant components cooled by the service water system are located in separate areas of the ESF area, which is inside the Seismic Category I auxiliary building. At the interface between the service water system and the ultimate heat sink, the service water pumps are protected by a semisic Category I structure designed to withstand the possible effects of tornadoes and flooding. This building is site-related and will be described in the Utility-Applicant's SAR. The piping from the service water pump discharge is buried underground. The piping and all supports are designed to Seismic Category I requirements. The amount of earth cover is sufficient to protect the piping from tornado-generated missiles. These conditions together with the

classification of the service water system as Seismic Category I ensure that the system is capable of withstanding adverse environmental occurrences such as postulated earthquakes, tornadoes, and tornado-generated missiles. The non - essential loop is classified NNS and is Seismic Category I.

The physical separation of the two essential loops precludes coincident damage to redundant equipment in the event of a postulated pipe rupture, equipment failure, or missile generation. Protection against dynamic effects associated with the postulated rupture of piping are discussed in Section 3.6.

9.2.1.4 Tests and Inspections

Components in operation will be alternated periodically to enable
testing and inspection. The standby components will be inspected 9
to find and correct incipient malfunctions. Sufficient
instrumentation is provided to monitor system performance.

The service water components are positioned to allow access for 9
periodic examinations as required by the ASME B&PV Code.

9.2.1.5 Instrumentation

A detailed description of the instrumentation provided for the service water system is included in subsection 7.3.1.

9.2.1.6 Interface Requirements for the service water system are described in Table 9.2-5

9.2.2 Component Cooling Water System

9.2.2.1 Design Bases

The component cooling water system provides an intermediate barrier between those radioactive or potentially radioactive system components requiring cooling and the service water system.

The CCWS, a closed-loop system, is designed to perform the
following functions: to remove residual heat from the RCS via
the RHR system during plant cooldown; to cool the letdown flow to
the CVCS during normal operation; to cool ESF heat loads after an
accident; and to dissipate heat rejected from various plant 9
components in a manner that precludes direct leakage of
radioactive fluids to the ultimate heat sink. The heat loads and

flow rates required to perform these various functions are listed in Tables 9.2-6 and 9.2-7.

The CCWS is designed to accommodate a range of inlet service water design temperature, i.e., 85 F, 95 F, and 100 F. The CCWS flow rates are established by the cooling requirements of plant components under various operating modes. The CCWS heat exchangers are resized for each service water design temperature to maintain the same heat exchange capacity with a constant service water flow rate (subsection 9.2.1). The CCWS provides cooling water in sufficient quantity and within the temperature limits of 105 F during normal plant operation and 120 F during reactor cooldown or after a postulated LOCA. With this design, three CCWS heat exchanger sizes, which become progressively smaller as the inlet service water design temperature is reduced, are used. The largest heat exchanger design is used for the purpose of space allocation within the ESF area. The CCWS design parameters presented in Table 9.2-8 are based on the forementioned criteria and on cooling the various plant components listed in subsection 9.2.2.2.

The CCWS is required to function during normal operation and during and after a postulated LOCA. Equipment required for safe shutdown is included on two identical redundant loops, the essential cooling loops. Flow in each essential loop is supplied by pumps powered from the emergency buses. Separate and independent emergency diesel generators supply power in the event of loss of primary and alternate offsite power. The onsite emergency power system is described in Section 8.3. The remaining plant components are cooled on a nonessential loop. The two essential loops are physically separated from each other and can be automatically or manually isolated.

The CCWS is maintained at a higher pressure than the service water system to prevent leakage of the untreated service water which may contain impurities. This protects certain plant components cooled by the CCWS against possible chloride-induced stress corrosion.

The two essential loops of the system are designated safety Class 3 and in accordance with the ASME B&PV Code, Section III. All non-nuclear safety-related portions of the loop can be remotely isolated from the control room. The safety Class 3 portion of the loop is Seismic Category I and protected against the effects of tornado. The nonessential loop is classified NNS and is Seismic Category I. 9

9.2.2.2 System Description

The two essential loops of the CCWS are shown on Figure 9.2-2; the portion of the nonessential loop outside of the containment is shown on Figure 9.2-3; the portion inside containment is shown on Figure 9.2-4.

The CCWS consists of two separate and independent, full-capacity essential loops and one nonessential loop. Each of the essential loops is equipped with two 100-percent capacity CCWS pumps and one CCWS heat exchanger. The nonessential loop may be supplied by the pumps and heat exchanger of either essential loop.

All the components required to be cooled following a LOCA are included in each of the essential loops. The following is a comprehensive list of the components included on each loop:

a. CCW pump cooler 4

b. RHR heat exchanger

c. Containment spray pump cooler

d. RHR/low-head safety injection (LHSI) pump cooler 9

e. Auxiliary feedwater pump cooler

f. Centrifugal charging pump cooler

g. Safeguard chilled water system

h. Spent fuel pool heat exchanger

The above components, except the spent fuel pool heat exchanger, are required to operate following a LOCA. The spent fuel heat exchangers are isolated after a LOCA on a phase B containment isolation signal, but they are included in the essential loops so that they may receive cooling water ten hours later to prevent boiling of the spent fuel pool. The above is a complete list for 9
those sites with acceptable quality water available for use in the service water system. On sites with unsuitable quality water, the emergency diesel generators will be cooled by the essential loops of the CCWS and the size of the CCW heat exchangers will be increased accordingly. The essential loops are redundant in that the

components supplied with cooling water by one loop are sufficient to perform the required safeguard functions. They are separated from each other by at least two valves at any interconnection.

The remaining components requiring cooling water are included on the nonessential loop. Components cooled by the nonessential loop external to the containment are as follows:

a. Health physicist office and service area air conditioning 4

b. Instrument and service air aftercooler and compressor

c. Process sample heat exchangers

d. Recycle evaporator package 9

e. High activity waste evaporator package

f. Low activity waste evaporator package

g. Seal water heat exchanger 4

h. Letdown heat exchanger

i. Catalytic recombiners 9

j. Waste gas compressor package

k. Plant ventilation chillers 4

l. BTRS sample cooler 9

m. GFFD sample cooler

The above is a list of components to be cooled for those sites with acceptable quality water available for use in the service water system. On sites with unsuitable quality water, the CVCS 2 chiller unit is cooled by the nonessential loop of the CCWS. Components cooled by the nonessential loop in the containment are as follows:

a. Reactor coolant pumps

b. Excess letdown heat exchanger

c. Reactor coolant drain collection tank heat exchanger 1

d. Reactor coolant pump motor air coolers | 4

Under normal operation, a single CCWS pump and single CCWS heat exchanger of the same essential loop are adequate for normal plant operation. If the operating CCWS pump trips, the second CCWS pump in the operating essential loop automatically starts. 9
In the unlikely event of a fault occuring in the operating essential loop instrumentation, logic is provided to automatically transfer operation to a pump and heat exchanger of the other essential loop. If one CCWS pump is taken out of service for maintenance, the second full-capacity pump in the same essential loop is available for service. Cooling water is normally supplied through the operating heat exchanger to both essential loops and to the nonessential loop; however, only one spent fuel pool heat exchanger is required for normal operation.

To facilitate cooldown, the CCWS uses two CCWS pumps and two CCWS heat exchangers to supply cooling water to both essential loops and the nonessential loop. A slower but acceptable cooldown rate may be accomplished with only one CCWS pump and one CCWS heat exchanger aligned to one essential loop and the nonessential loop. Under both conditions, the maximum component cooling water temperature at the CCW heat exchanger outlet is 120 F for a maximum period of 4 hours, after which the temperature gradually returns to 105 F.

Under accident conditions, on receipt of an S signal, a pump in the other essential loop is started and flow from two pumps is supplied to all loops. Upon receipt of the containment isolation signal, Phase B, the nonessential loop is automatically isolated from the rest of the system, and the two essential loops are isolated from each other. Although only one essential loop is required to mitigate the consequences of an accident, component cooling water is supplied to both essential loops. A single 9
failure of any component does not prevent the system from supplying water to one essential loop, as described in Table 9.2-9.

A partitioned surge tank, vented to atmosphere, accommodates surges resulting from component cooling water thermal expansion and contraction, and it collects any water that may leak into the system from components being cooled. The CCWS surge tank is located at elevation 167 feet, 6 inches which assures proper operation of the CCWS pumps. A drop or rise in the surge tank level during steady operation indicates leakages within the

system. The surge tank level is indicated both locally and in the control room, where high and low levels are annunciated.

One chemical addition tank is supplied. Upon detection of 4
in-leakage, manual adjustments are made at the component cooling surge tank, until dissolved solids and corrosion inhibitor design concentrations as specified in RESAR-414 Section 1.7.1. are 9
achieved.

Makeup water is normally delivered to the surge tank from the demineralized water storage tank or the reactor makeup water storage tank, with automatic operation of the tank level control valves. Under emergency conditions, makeup water can be supplied 9
from the Seismic Category I portion of the fire protection system. See subsection 9.2.3 and 9.5.1 and Figures 9.2-6 and 9.5-1A.

Radiation detectors monitor the CCWS. If the radiation level of the cooling water exceeds a predetermined value, an alarm is given in the control room and the vent on the CCWS surge tank is automatically closed. A vacuum breaker and a relief valve are provided to protect the surge tank.

9.2.2.3 Safety Evaluation

The CCWS is comprised of two full-capacity essential loops and one nonessential loop. During emergency operation, the nonessential loop is automatically isolated from the essential loops. The two loops are separated from each other by two automatically operated valves. The failure of the nonessential cooling loop has no adverse affect on plant capability to safely shutdown the plant or maintain the plant in a safe shutdown 9
condition.

One branch of the nonessential loop supplies a header which penetrates the reactor containment and supplies the reactor coolant pumps with the required cooling water. A second branch of the nonessential loop provides cooling water to the heat exchangers inside the containment. Each containment penetration is safety Class 2 and has an automatic isolation valve, with 9
position indicator and manual operator, located outside the containment. One check valve is provided on the CCWS supply line inside the containment to prevent reverse flow, in case of a pipe rupture. CCW piping between the RC pump thermal barrier and the outer containment isolation valve is designed for full RC loop pressure and temperature.

The performance of all components is monitored from the control room. Low flow, low pressure, high temperature, and high radiation level, which are all indicative of system malfunctions, are annunciated in the control room.

Leakage from any system being cooled by the CCWS is detected by an increase in the level of the CCWS surge tank or by an increase in the system radiation level, when the system being cooled is contaminated. Details of the radiation-monitoring equipment are given in Section 11.5. Leakage from the CCWS to the service water system or to the atmosphere is detected by a decrease in the CCWS surge tank level.

A partition in the surge tank provides separate surge volumes for each essential loop. If one essential loop develops a leak and is taken out of service, the operation of the other loop is unaffected. If a leak develops in the nonessential loop, it can be isolated from the essential loops and operation is unaffected. The partition is designed to maintain its integrity while one side of the surge tank is empty. All components of the CCWS are located inside of a Seismic Category I structure. The CCWS pumps, the heat exchangers, and the essential loops are in the ESF area. The components of the two essential loops are physically separated within the ESF area by a dividing structure. 9
The CCWS pumps are located at elevation 94 feet, 6 inches, which is above the flooding level that can occur due to equipment failure within the building. These conditions, together with the classification of the CCWS as Seismic Category I, make the system capable of withstanding adverse environmental occurrences such as postulated earthquakes, tornadoes, and tornado-generated missiles.

The physical separation of the two essential loops precludes coincident damage to redundant equipment in the event of a postulated pipe rupture, equipment failure, or missile generation. Protection against dynamic effects associated with the postulated rupture of piping are discussed in Section 3.6.

9.2.2.4 Tests and Inspections

Periodic chemical examination of the component cooling water is made for pH, chloride content, and corrosion inhibitor content; if required, manual adjustment is made utilizing the chemical addition tank to meet the Westinghouse chemistry specifications listed in RESAR-414 Section 1.7.1. Periodic visual inspection 6
and preventive maintenance can be conducted as necessary without interruption of cooling system operation.

Sufficient instrumentation is provided to monitor system performance.

The CCWS components are positioned to allow access for periodic 1
examinations as required by the ASME Code.

The integegrity of the partition in the surge tank will be determined periodically by raising the water level in one section
of the tank to the high water level and observing if there is an 6
equalization of the levels. An equalizing of the levels would be indicative of a leak in the partition.

9.2.2.5 Instrumentation

A detailed description of the instrumentation provided for the CCWS is included in subsection 7.3.1.

9.2.2.6 Interface Requirements

The interface requirements for the component cooling water system is described in Table 9.2-10.

9.2.3 Demineralized Water Storage, Deaeration and Makeup System 1

9.2.3.1 Design Basis

This system furnishes deaerated demineralized water, for use as a reactor coolant and as secondary plant makeup, and demineralized water for use throughout the plant.

9.2.3.2 System Description

The demineralized water storage, deaeration and makeup water system consists of a demineralized water storage tank, reactor
makeup water storage tank, vacuum deaerator, and the 9
demineralized and reactor makeup water distribution systems. Water from the demineralized water treatment system (subsection 9.2.7) is delivered directly to the demineralized water storage tank. The quality of water in the demineralized water storage tank is better than 2.0 micromhos/cm at 25 C; however, this water is saturated with oxygen. For water chemistry see Table 9.2-12.

The demineralized water is supplied by two demineralized water transfer pumps to the demineralized makeup water distribution system or to the vacuum deaerator as shown on Figure 9.2-5. The

demineralized water makeup distribution system is shown on Figure 9.2-6.

The demineralized water transferred to the vacuum deaerator is deaerated to remove dissolved oxygen to a concentration of 0.1 mg/l, before it is supplied to the condensate storage tank, the reactor makeup water storage tank, the auxiliary feedwater

storage tank, and RWST, as required by their respective levels. From the reactor makeup water storage tank the reactor makeup water system, shown also on Figure 9.2-6., provides demineralized deaerated water to the RCS, Steam Generator Blowdown System and auxiliary equipment. Two reactor makeup water pumps take suction from the reactor makeup water storage tank and these pumps discharge through a system of headers. As a minimum, one reactor makeup pump operates continuously. The system (including tanks, pumps, connections to the boric acid blender, the pressurizer relief tank, and the component cooling water surge tank) is 9
designed as non-Seismic Category I.

The reactor makeup water storage tank is provided with heating systems for freeze protection if required by site conditions. Any freeze protection provided will be discussed in the Utility-Applicant's SAR. The water temperature is continuously measured and indicated on the control room panel. 6

The demineralized water storage tank, reactor makeup water storage tank, and the condensate storage tank are all non-nuclear safety-related, non-Seismic Category I tanks located outside the auxiliary building. Depending on the site, the tanks and associated piping, if necessary, are provided with heating 9
systems for freeze protection.

9.2.3.3 Safety Evaluation

Sufficient storage capacity of 250,000 gallons in the demineralized water storage tank is available to supply makeup 9
water for 8 hours in the event that the demineralized water treatment system is out of service.

The demineralized water treatment plant does not contain, treat, or produce any radioactive material; any waste produced by this system is transferred directly to the chemical waste disposal system.

The reactor makeup water storage tank (160,000 gallons) is of 6
sufficient size to provide the makeup requirements of the
component cooling water system (50 gpm) or the safety-related
chilled water system (50 gpm) until corrective action can be 9
taken.

9.2.3.4 Tests and Inspections

The equipment is initially inspected and tested to ensure system integrity and completeness.

9.2.3.5 Instrumentation Application

The demineralized water makeup system is controlled from local panels. The system operation is designed to be fully automatic with a provision for manual control. The final water quality is continuously monitored for conductivity, pH, and silica. High-conductivity and high-silica concentrations are alarmed locally and in the control room. The pH is recorded locally. Deviations from specified water quality cause the pumps to trip which prevents poor quality water from entering the demineralized water storage tank. Regeneration is manually initiated and proceeds automatically until completion.

9.2.3.6 Interface Requirements

The interface requirements for the demineralized makeup water system are described in table 9.2-11.

9.2.4 Potable and Sanitary Water Systems

The potable and sanitary water system supplies water for toilets, sinks, showers, drinking purposes, and miscellaneous plant use. It is completely separated from the laundry and hot shower portion of the liquid waste processing system.

This system will be presented in the Utility-Applicant's SAR.

9.2.5 Ultimate Heat Sink

The ultimate heat sink is used to dissipate heat rejected from the station service water system to permit safe shutdown and cooldown of the plant and maintain it in a safe shutdown condition and to dissipate heat rejected from the plant in the event of an accident.

The system is site-related and will be presented in the Utility-Applicant's SAR.

9.2.5.1 Interface Requirements

The interface requirements for the ultimate heat sink is described in Table 9.2-14.

9.2.6 Condensate Storage Facilities

The condensate storage facility primarily provides makeup and surge capacity for secondary system inventory changes caused by different operational conditions, thermal effects, and draining or filling of any part thereof.

9.2.6.2 System Description

The condensate storage facility consists of one tank (Figure 9.2-7) of sufficient capacity to accommodate system surge, auxiliary feed and makeup water requirements.

The tank is constructed of coated carbon steel and designed in accordance with the requirements of API 620.

9.2.6.3 Safety Consideration

The condensate storage tank is not required to ensure the following:

a. The integrity of the RCPB

b. The capability to shut down the reactor

c. The capability to prevent or mitigate the consequences of accidents which can result in potential offsite exposures (guidelines of 10 CFR Part 100).

The tank is non-nuclear safety-related. The possibility exists that activity may be present in the condensate storage tank. The activity is dependent on the percentage of failed fuel and ruptured steam generator tubes. A detailed discussion on secondary site activity is presented in subsection 10.2.4.

Depending on the site, the tank is provided with a heating system to prevent freezing or icing.

9.2.6.4 Tests and Inspections

Visual inspection is periodically performed after construction.

9.2.6.5 Instrumentation

Tank water level indication is provided, both locally and in the control room. Annunciation is provided in the control room for high and low water levels.

9.2.6.6 Interface Requirements

RESAR-414 interface requirements for the condensate storage facility are only applicable when this tank is used to supply 6
auxiliary feedwater. Auxiliary feedwater is supplied from a separate storage tank. See Section 10.4.9.

9.2.7 Demineralized Water Treatment System

The demineralized water treatment system provides pretreated and 1
filtered water for use in the potable and sanitary water system and as influent to the demineralized water storage, deaeration, and makeup water system.

The demineralized water treatment system is site-related and will be presented in the Utility-Applicant's SAR.

9.2.8 Plant Ventilation Chilled Water System

9.2.8.1 Design Bases

The plant ventilation chilled water system is designed to provide an uninterrupted flow of cooling water to the following areas during normal operation.

a. The controlled access supply units.

b. Main Steam & Feedwater Auxiliary cooling units

c. Controlled Access Supply Equipment Room Auxiliary Cooling Units 9

d. The charging pump rooms auxiliary cooling units

e. The containment recirculation air cooling units

f. the neutron-detector well cooling units

During loss of offsite power, the controlled access supply units are not supplied with chilled water.

The system consists of four 33-1/3-percent-capacity chiller units and four 33-1/3-percent-capacity pumps, both of which are individually connected to Class IE electrical buses supplied by the onsite standby power system described in section 8.3. The chiller units are not required at sites where service water of a high quality and adequate temperature (below 90 F) is available.

Component cooling water will be used instead of service water at 1
sites which have poor service water quality. The temperature limit of 90 F will still apply in these cases. 1

A chilled water expansion tank is connected to the demineralized water system and the return line of the chilled water system. Sufficient redundancy is incorporated into the system design to effectively handle a single-failure of any of the active 9
components.

The system is non-nuclear-safety-related, except as noted on Figure 9.4 9, and the portion inside the containment is designed to Seismic Category I requirements.

9.2.8.2 System Description

The plant ventilation chilled water system is shown schematically on Figure 9.4-9. The system design includes: four 33-1/3-percent-capacity chiller units; four 33-1/3-percent-capacity pumps; a chilled water expansion surge tank; and associated piping, valves, and instrumentation. The standby chiller unit and pump are manually started should any 9
single active component fail in the operating units.

During normal operation cooled water is delivered by the manually operated water pump-chiller unit arrangements via a piping system to all five areas specified in subsection 9.2.8.1. The water flow rate provided by the chillers is monitored and controlled and is contingent on the temperature of the air entering the cooling coil in each area being served. Automatically operated valves regulate the flow of chilled water to the equipment 9
cooling the specified areas. The temperature of the chilled water is monitored, and kept constant.

A recirculation line fitted with valves, flow meter, and a
differential pressure transmitter links the outlet supply header
of the chillers with the system return header and helps transport
chilled water, when the differential pressure becomes low back to 1
the suction side of the chilled water pumps. The chilled water
expansion tank directly connects with both the demineralized
water system and the plant ventilation chilled water system. It
either provides makeup water to or receives water from the
chilled water system depending upon thermal expansion,
contraction or leakages occurring within the system. A valve 9
arrangement is provided at the demineralized water connection
(see figure 9.4-9) to control the flow from the demineralized
water system into the tank. The tank is provided with a vent and
a drain connected to the floor drain system. Expansion tank
water levels are monitored and indicated in the control room at
all times. Annunciators indicate design low-water levels.

After a containment isolation signal, the containment isolation
valves in the supply and return lines, which supply water to the
containment recirculation and neutron detector well cooling
coils, are automatically closed, as required. The plant
ventilation chillers and the recirculation pumps are
automatically shutdown upon reciept of a containment isolation 9
signal, and during loss of offsite power.

After a loss of offsite power the emergency standby diesel
generators automatically power the Class 1E electrical buses.
The plant ventilation system is "not" needed for "safe" plant
shutdown. However, the containment portion of this system will
operate during a loss of offsite power or shutdown to avoid
possible damage, of non-safety related equipment. This requires 9
the operation of two chillers. The plant venlitation system is
automatically tripped on reciept of an "S" signal.

a. Leakage and Control

The chilled water system expansion tank accommodates surges resulting from the thermal expansion or contraction of water. A significant drop (i.e. below a predetermined value) in the expansion tank level during steady operation implies leakages within the system. The expansion t..... level is indicated locally and in the control room. High- and low-water levels are annunciated in the control room. The demineralized water system

supplies makeup water, required when the tank level falls below a predetermined value, and a drain pipe discharges excesses to the floor drain system

b. Components

The plant ventilation chilled water system is non-nulcear safety-related and is shown on Figure 9.4-9.

1) Chiller Units

Centrifugal compressor type water chilling units are used. The evaporator is a shell-and-tube heat exchanger cooled by the CCWS. |9

2) Pumps

The plant ventilation chilled water system pumps are of the horizontal, centrifugal, single-stage type. They are fabricated of carbon steel.

3) Expansion Tank

The expansion tank accommodates changes in chilled water volume. The tank is constructed of carbon steel.

4) Valves

The valves provided in the plant ventilation chilled water system are fabricated from carbon steel. Spring-loaded relief valves are provided for lines and components that could become pressurized beyond their design limits.

5) Piping

All chilled water piping is fabricated from carbon steel, with welded joints and connections. Exceptions occur for certain components where flanged connections are used to facilitate maintenance.

9.2.8.3 Safety Evaluation

The system is non-nuclear safety related and Seismic Category I in the containment to avoid damage to adjacent safety related 9
equipment.

The performance of all essential equipment is monitored from the control room. Low or high flows, pressures, and temperatures which would reflect system malfunction are visually and audibly annunciated in the control room. Leakage in the system can be identified by control room indicators. The operator takes appropriate action to curb a continued deterioration of system conditions.

All the major components of the system including piping and its appurtenances, are located inside Seismic Category I structures. The pumps are arranged in parallel and connected to the chiller units (in parallel) and are located in the primary plant 9
ventilation equipment area of the auxiliary building. Redundancy in equipment is sufficient to handle all conditions, normal or adverse, attendant with the design modes of operation.

Failure of a single component of the plant ventilation chilled water system does not have an adverse effect on the ability to safely shutdown the plant or to maintain the plant in a safe shutdown condition.

9.2.8.4 Tests and Inspection Requirements

Shop inspection and testing are performed for all rotating equipment and modular controls. The system is initially tested for proper flow paths, flow capacities, and mechanical operabilities and is adjusted accordingly.

Periodic chemical examination of the chilled water is made for pH and corrosion-inhibitor content, and adjustments are made, if required. Sufficient instrumentation is provided to monitor system performance. Periodic visual inspection is conducted, as required, without interrupting system operation.

9.2.8.5 Instrumentation Requirements

The system is provided with instrumentation to allow the complete monitoring of the system from the control room. 9

The pumps, and the chiller units (when these are provided) are started individually from switches in the equipment room. Pressure transmitters located at the inlet and outlet of the 9 pumps permit the indication of these pressures in the control room. A low

outlet pressure at any pump, implying malfunction of the unit, is annunciated audibly and visually in the control room. 9

At sites where chiller units are employed, temperature sensors placed at the outlet of the chillers provide temperature indication locally and in the control room. The chillers are set to deliver water at a predetermined temperature which is indicated by the temperature elements at the outlet side. Large deviations above the preset temperature, implying unit malfunction, are annunciated audibly and visually in the control room. The standby chiller unit may be manually started by the operator.

A differential pressure transmitter located across the supply and return water lines monitors and indicates (in the controls room) pressure differentials. The transmitter also controls the 1
modulating valve that regulates the recirculation flow to the return water line, which helps to maintain the constant head flow delivered by the pump. Flow elements and transmitters enable the display of flow rates, locally and in the control room.

Temperature elements located in the ductwork downstream of the 9
cooling coils, controls the modulating valves that regulate the water flow rates through these coils. The temperature in each area is indicated locally. The valves that regulate the flow into the charging pump rooms auxiliary cooling units are manually opened and closed from the control room. 1

During loss of offsite power two chillers and two pumps are required to prevent damage to non-safety related equipment inside the containment and are manually powered by the Class IE 9
electrical bus. During a LOCA the containment is isolated and the system tripped, automatically.

9.2.9 Ventilation Safety Features Chilled Water System

9.2.9.1 Design Bases

The ventilation safety features chilled water system is designed to provide a forced flow of cooling water to cooling coils located in the following areas during normal and emergency conditions:

a. RHR pump room (elevation 72 feet, 6 inches)

b. Containment spray pump room (elevation 72 feet, 6 inches) 9

c. Safety injection pump room (elevation 72 feet, 6 inches)

d. Component cooling water pump room (elevation 94 feet, 6 inches) 9

e. Auxiliary feedwater pump room (elevation 94 feet, 6 inches) 9

f. Water sampling station (later)

g. Spent fuel pool cooling pump room (elevation 94 feet, 6 inches) 9

h. Uncontrolled access areas (elevations 150 feet, 6 inches and 100 feet, 6 inches)

i. Controlled access area exhaust equipment room (elevation 146 feet, 6 inches)

j. Control room (elevation 130 feet, 6 inches) 9

Chilled water delivered to each area is contingent on the mode of operation used at the particular time.

The system is comprised of two independent trains. Each train consists of two 50-percent-capacity water pumps, one 100-percent-capacity chiller unit, associated piping, valves, and controls. The chiller units are not required at sites where cooling water, either service water of a high quality or CCW system water, is available at a temperature below 70°. Each 9 train is connected to a separate Class IE electrical bus supplied by emergency standby diesel generators.

The return water line of each train is as shown in Figure 9.4-5 connected to a separate chilled water expansion tank. Each tank is connected to the reactor water makeup water system, fire 9 protection system and the demineralized water system through a common header.

Redundancy of equipment and power supplies is incorporated into the system design to compensate for a single failure of any component. 9

The system is designed to Seismic Category I and ASME Code III requirements, and classified as ANSI nuclear safety class 3. 9

9.2.9.2 System Description

The ventilation safety feature chilled water system is shown schematically on Figure 9.4-5

The system design includes two trains, each comprised of two 50-percent-capacity water pumps, one 100-percent-capacity centrifugal-type chiller unit, piping, valves, and controls. The trains are physically separated by the valve arrangements as shown in Figure 9.4-5. The pumps and chiller on a single train are sized to handle the total of postulated heat loads to which the train could be subjected. Consequently one train is normally operational while the other remains on standby.

During normal operation, cooled water is delivered by a manually started water pump-chiller unit arrangement via a piping network to the areas specified in subsection 9.2.9.1 (except areas specified in a, b, and c). The RHR pump-room coils which are interlocked with the RHR pumps are supplied during reactor startup, reactor shutdown and LOCA. The containment spray pump and safety injection pump room auxiliary cooling coils which are interlocked to the pumps are supplied following a LOCA or when the pumps are tested. The water flow rate of each pump train is 9
monitored and is contingent on the chilled water supply to each cooling coil. Each of these water supplies is constant, except that through the uncontrolled access area and control room cooling coils which are regulated by temperature modulated valves with provision for manual operation from the control room. The chilled water flow to each coil depends on the design temperature for that area. The temperature of the chilled water distributed to the areas served is monitored and indicated locally and in the control room. This temperature can be maintained constant by properly setting the chiller units when these are included in the system design. However, when service water or CCW system water is used for cooling this temperature may fluctuate. 9

Redundant recirculation lines fitted with valves, flow meter, and differential pressure transmitter links the outlet supply header of the chillers with the system return header. This aids in the transportation of cooled water not required by the cooling coils back to the suction side of the chilled water pumps. The amount of recirculation flow depends on the differential pressure 1
existing across the supply and return water lines. 9

The chilled water expansion/surge tanks are linked with the
demineralized water system, the fire protection system, and the
reactor makeup water system. The fire protection or reactor 9
makeup water systems are utilized when demineralized water is not
available. Their function is to provide makeup water to the
chilled water system. Makeup water is required as a result of
leakages or thermal contraction within the system, whereas
receipt of water by the expansion/surge tanks is a result of
water thermal expansion within the system. The tanks vent to the
floor drain system via a common header. The piping system
provided with the tanks is fitted with valves and controls which
are operated locally or remote manually from the control room.
Surge tank water levels are monitored at all times and displayed
locally and in the control room. Annunciators indicate high and
low levels. A failure in one loop does not affect the 9
performance of the other.

a. Leakage and Control

The chilled water expansion tanks accommodate surges resulting
from the thermal expansion or contraction of water. To maintain
the desired pressurization within the system the tank is located
at an elevation above all components in the system. A drop below
a predetermined level in either surge tank level during operation
indicates leakage within the system. The water levels in the
tanks are indicated locally and in the control room.

9

The fire protection system provides a Seismic Cateorgy I source
of makeup water needed by the ventilation safety feature chilled
water system during accident conditions and when the
demineralized water system is nonoperational or overburdened, or
both. An outlet header discharges excess water from the tanks to
the floor drain system.

b. Components 9

1) Chiller Units

Centrifugal compressor type water chilling units are
used in both trains. The evaporator is a shell-and-tube
heat exchanger with the refrigerant in the shell side.
The condenser is of the shell-and-tube heat exchanger
type and is cooled by CCWS water. 9

2) Pumps

The pumps, used in both trains are of the horizontal centrifugal type.

3) Expansion Tanks

The expansion tanks are constructed of carbon steel, and 9
are sized to accommodate changes in chilled water volume.

4) Valves

The valves fitted to the system piping are fabricated out of carbon steel. 9

5) Piping

All chilled water piping is fabricated out of carbon steel with welded joints and connections, except for certain components where flanged connections are used to facilitate maintenance.

9.2.9.3 Safety Evaluation

The system is designed to ANSI safety Class 3 and Seismic Category I. During an emergency mode, all the cooling coils 9
served by this system become functional automatically opening the valves that allow flow of chilled water through these coils.

The performance of all essential equipment is monitored from the control room. Low or high flows, high or low pressure or temperature conditions, all of which would affect the system adversely, are annunciated in the control room. Leakage in the system can be identified, locally and in the control room by the water level indicators. The operator must take appropriate action to avoid further deterioration of the system conditions.

All the major components of the system, including piping and its appurtenances, are located inside Seismic Category I structures. These structures which enclose the pumps and chiller units are designed to preclude coincident damage to redundant equipment in the event of a postulated pipe rupture, equipment failure, or missile generation. The pumps and chiller units are located at an elevation which is above the highest water level that might occur as a result of equipment failure within the auxiliary building. Redundancy in trains is sufficient to handle normal or adverse conditions concomitant with the design modes of
operation. Standby equipment is automatically started as the 6
failed unit becomes inoperable. See Section 9.2.9.5. 9

Failure of a single component within the ventilation safety feature chilled water system does not have an adverse effect on the ability to either safely shut down the plant or to maintain it in a safe shutdown condition.

9.2.9.4 Tests and Inspections 1

Shop inspection and testing are performed for all rotating equipment and modular controls. The system is initially tested for proper flow path, flow capacities, and mechanical operabilities and is adjusted accordingly. Periodic chemical examination of the chilled water is made for pH and corrosion inhibitor content; manual adjustment is made, if necessary.

Sufficient instrumentation is provided to monitor the system performance. Periodic visual inspection is conducted, as required, without interrupting the system operation.

9.2.9.5 Instrumentation

The system is provided with instrumentation that allows the monitoring and control of the system from the control room.

The two pumps and the chiller unit on a single train are interlocked and started manually from a switch in the control
room. Pressure transmitters located at the inlet and outlet of 1

the pumps permit indication of these pressures on the control | 1

room panels. A low differential pressure across any pump, implying unit malfunction, is annunciated audibly and visually in the control room. The standby pumps-chiller arrangment is automatically started as the failing equipment is tripped. 9

At sites where chiller units are employed, temperature sensors placed at the outlet of the chillers provide temperature indication both locally and in the control room. The chillers are set to deliver water at a predetermined temperature which is indicated by the temperature elements at the outlet side. Large deviations above the preset temperature, implying unit 1 malfunction, are annunciated audibly and visually in the control room. A differential pressure transmitter located across the supply to the return water line, helps detect any leaks in the system and balance the flows. Flow elements and transmitters enable the indication of flow rates, locally and in the conrol 9 room.

Temperature elements located in the areas served by the uncontrolled access area cooling coils provide indication of temperature locally and in the control room. The valves that regulate flow into these cooling coils modulate as a function of 6 temperature. When a failure or LOCA occurs they go full open.

During loss of offsite power the functional unit is automatically powered by the class IE electrical bus. During a LOCA the cooling coils required for safe shutdown of the plant are automatically supplied with chilled water whereas those not needed can be manually isolated from the control room. The valves that physically separate the trains close automatically 6 when a LOCA occurs.

High and low level of the expansion tanks are alarmed audibly 9 and visually in the control room

TABLE 9.2-1
(Sheet 1 of 2)

SERVICE WA[illegible] TOTAL HEAT LOADS (10^6 Btu/hr)
(Westinghouse - 414)

Component	Number Provided	Startup In Serv.	Startup Heat Load	Normal Oper. In Serv.	Normal Oper. Heat Load	Plant Shutdown at 4 hrs. In Serv.	Plant Shutdown at 4 hrs. Heat Load	Plant Shutdown at 20 hrs. In Serv.	Plant Shutdown at 20 hrs. Heat Load	Refueling In Serv.	Refueling Heat Load
1. Essential Cooling Loop CCW Heat Exchanger	2	2	153.42	1	106.00	2	337.77	2	174.30	2	173.71
Emergency diesel generator	2	-	-	-	-	-	-	-	-	-	-
2. Nonessential Cooling Loops CVCS chiller unit	1	-	-	1	3.42	-	-	-	-	-	-
Total			153.42		109.42		337.97		174.30		173.71
Total (assuming single failure criteria-one 100% train in operation)			153.42		109.42		192.99		127.63		127.19

TABLE 9.2-1 1
(Sheet 2 of 2)

SERVICE WATER TOTAL HEAT LOADS (10^6 Btu/hr) 9
(Westinghouse - 414)

	Safety Injection						Loss of Power				
	Safety Phase A Isolation		Phase B Isolation		Recirculation		Hot Shutdown		Cooldown at 20 hrs.		
Component	In Serv.	Heat Load	In Serv.	Heat Load	In Serv.	Heat Load	In Serv.	Heat Load	In Serv.	Heat Load	1
1. Essential Cooling Loop CCW Heat Exchanger	2	39.27	2	6.32	2	342.12	2	70.96	2	147.25	9
Emergency diesel generator	2	36.0	2	36.0	2	36.0	2	36.0	2	36.0	
2. Nonessential cooling loop											1
CVCS Chiller Unit	-	-	-	-	-	-	-	-	-	-	
Total		75.27		42.32		378.12		106.96		183.25	9
Total (assuming single failure criteria-one 100% train in operation)		56.61		23.66		214.06		88.73		118.59	1

TABLE 9.2-2
(Sheet 1 of 2) 1

SERVICE WATER FLOW RATES (gpm)
(Westinghouse - 414)

Component	Number Provided	Startup No. Cooled	Startup Flow Rate	Normal Oper. No. Cooled	Normal Oper. Flow Rate	Plant Shutdown at 4 hrs. No. Cooled	Plant Shutdown at 4 hrs. Flow Rate	Plant Shutdown at 20 hrs. No. Cooled	Plant Shutdown at 20 hrs. Flow Rate	Refueling No. Cooled	Refueling Flow Rate	
												9
1. Essential Cooling Loop												1
CCW heat exchanger	2	2	30,000	1	15,000	2	30,000	2	30,000	2	30,000	9
Emergency diesel generator	2	2	2,700	1	1,350	2	2,700	2	2,700	2	2,700	
2. Nonessential Cooling Loop												1
CVCS chiller unit	1	1	1,000	1	1,000	1	1,000	1	1,000	1	1,000	
Total			33,700		17,350		33,700		33,700		33,700	9
Total (assuming single failure criteria- One 100% train in operation)			17,350		17,350		17,350		17,350		17,350	
												1

TABLE 9.2-2
(Sheet 2 of 2)

SERVICE WATER FLOW RATES (gpm)
(Westinghouse - 414) 1

	Safety Injection Phase A Isolation		Safety Injection Phase B Isolation		Recirculation		Loss of Power				
							Hot Shutdown		Cooldown at 20 hrs.		
Component	No. Cooled	Flow Rate	No. Cooled	Flow Rate	No. Cooled	Flow Rate	No. Cooled	Flow Rate	No. Cooled	Flow Rate	
1. Essential Cooling Loop											
CCW heat exchanger	2	19,000	2	19,000	2	19,000	2	30,000	2	30,000	9
Emergency Diesel generator	2	2,700	2	2,700	2	2,700	2	2,700	2	2,700	
2. Nonessential Cooling Loop											1
CVCS chiller unit	1	1,000	-	-	-	-	1	1,000	1	1,000	
Total		22,700		21,700		21,700		33,700		33,700	9
Total (assuming single failure criteria-one 100% train in operation)		11,850		10,850		10,850		17,350		17,350	1

TABLE 9.2-3

SERVICE WATER SYSTEM DESIGN PARAMETERS

Service Water System Pumps

Quantity	four	
Type	centrifugal	
Fluid pumped	service water	
Design flow rate, gpm	19,000	9
Design head (TDH), ft	170	
Design temperature, F	150	
Motor size, Bhp	1000	9
Design code	ASME III	
Safety Class	3	
Seismic Category	I	

TABLE 9.2-4

SINGLE FAILURE ANALYSIS OF SERVICE WATER SYSTEM

	Component	Malfunction	Effect on System Safeguard Performance	Comments
1.	Service water pumps	stops pumping	no effect	Four 100-percent-capacity pumps are provided. One is required.
2.	Remotely operated stop valves for redundant header isolation	a. Fails to close	no effect	Valve redundancy is provided.
		b. Unwanted closure	no effect	Header redundancy is provided.
		c. Fails to open	no effect	Header redundancy is provided.
3.	Emergency diesel generator	fails to start	no effect	Pumps and stop valves for header isolation are redundant. Power for redundant component is supplied from a different diesel generator.
4.	Component cooling heat exchanger	loss of flow	no effect	Two 100-percent-capacity supply headers are provided.
5.	Piping	pipe rupture	no effect	Two 100-percent-capacity supply headers and two 100-percent-capacity return lines are provided.

 1

TABLE 9.2-6
(Sheet 1 of 6)

COMPONENT COOLING WATER TOTAL HEAT LOADS (10^6 Btu/hr) 9
(Westinghouse - 414)

Component	Number Provided	Startup In Serv.	Startup Heat Load	Normal Oper. In Serv.	Normal Oper. Heat Load	Plant Shutdown at 4 hrs. In Serv.	Plant Shutdown at 4 hrs. Heat Load	Plant Shutdown at 20 hrs. In Serv.	Plant Shutdown at 20 hrs. Heat Load	Refueling In Serv.	Refueling Heat Load	
1. Essential Cooling Loop CCW pump cooler	4	2	0.36	1	0.18	2	0.36	2	0.36	2	0.36	
RHR heat exchanger	2	1	27.0	-	-	2	289.6	2	92.6	2	92.6	9
Containment spray pump cooler	2	-	-	-	-	-	-	-	-	-	-	1
RHR/LHSI pump cooler	2	1	0.03	-	-	2	0.06	2	0.06	2	0.06	9
HHSI pump cooler	2	-	-	-	-	-	-	-	-	-	-	1
Auxiliary feedwater pump cooler	2	2	0.30	-	-	2	0.30	2	0.30	-	-	
Centrifugal charging pump cooler	2	1	0.08	2	0.17	2	0.17	1	0.08	-	-	9
Safeguard chilled water system	2	1	6.0	1	6.0	1	6.0	1	6.0	1	6.0	9
Spent fuel pool heat exchanger	2	1	25.5	1	25.5	1	25.5	1	25.5	1	25.5	9

TABLE 9.2-6 1
(Sheet 2 of 6)

COMPONENT COOLING WATER TOTAL HEAT LOADS (10^6 Btu/hr) 9
(Westinghouse - 414) 1

Component	Number Provided	Startup In Serv.	Startup Heat Load	Normal Oper. In Serv.	Normal Oper. Heat Load	Plant Shutdown at 4 hrs. In Serv.	Plant Shutdown at 4 hrs. Heat Load	Plant Shutdown at 20 hrs. In Serv.	Plant Shutdown at 20 hrs. Heat Load	Refueling In Serv.	Refueling Heat Load	
2. Nonessential cooling Loop												9 1
Evaporator concentrate storage tank	2	2	0.02	2	0.02	2	0.02	2	0.02	2	0.02	4
Instrument air aftercooler and compressor	2	1	0.25	1	0.25	1	0.25	1	0.25	1	0.25	9
Service air aftercooler and compressor	1	1	0.20	1	0.20	1	0.20	1	0.20	1	0.20	4
Sample heat exchanger	7	1	0.22	1	0.22	1	0.22	-	-	-	-	9
GFFD sample cooler		1	0.21	1	0.21	1	0.21	-	-	-	-	
Boron recycle evaporator package	1	1	8.81	1	8.81	1	8.81	1	8.81	1	8.81	1
High activity waste evaporator package	1	1	8.81	1	8.81	1	8.81	1	8.81	1	8.81	2
Low activity waste evaporator package	1	1	9.00	1	9.00	1	9.00	1	9.00	1	9.00	4 2
Seal water heat exchanger	1	1	2.4	1	2.4	1	2.4	1	2.4	1	2.4	
Letdown heater exchanger	1	1	33.50	1	20.0	1	11.6	1	6.2	1	6.2	1
Catatytic recombiner	2	1	0.07	1	0.07	1	0.07	1	0.07	-	-	
Plant ventilation chillers	4	3	13.5	3	13.5	3	13.5	3	13.5	3	13.5	9
Waste gas compresser package	2	1	0.13	1	0.13	3	0.14	1	0.14	-	-	

TABLE 9.2-6
(Sheet 3 of 6)

COMPONENT COOLING WATER TOTAL HEAT LOADS (10^6 Btu/hr)
(Westinghouse - 414)

Component	Number Provided	Startup In Serv.	Startup Heat Load	Normal Oper. In Serv.	Normal Oper. Heat Load	Plant Shutdown at 4 hrs. In Serv.	Plant Shutdown at 4 hrs. Heat Load	Plant Shutdown at 20 hrs. In Serv.	Plant Shutdown at 20 hrs. Heat Load	Refueling In Serv.	Refueling Heat Load
Reactor coolant pumps	4	4	3.0	4	3.0	1	0.75	-	-	-	-
Excess letdown heat exchanger	1	1	6.5	-	-	-	-	-	-	-	-
Reactor coolant drain collection tank heat exchanger	1	1	2.23	1	2.23	-	-	-	-	-	-
Reactor coolant pump motor air cooler	8	8	5.3	8	5.3	-	-	-	-	-	-
Total			153.42		106.00		337.97		174.30		173.71
Total (1)			76.71		- (5)		168.98		87.15		86.86
Total (2)			147.08		106.00		192.94		127.63		127.19

TABLE 9.2-6
(Sheet 4 of 6)

COMPONENT COOLING WATER TOTAL HEAT LOADS (10^6 Btu/hr)
(Westinghouse - 414)

Component	Safety Injection Phase A Isolation		Safety Injection Phase B Isolation		Recirculation		Loss of Power: Hot Shutdown		Loss of Power: Cooldown at 20 hrs.	
	In Serv.	Heat Load	In Serv.	Heat Load	In Serv.	Max Heat Load	In Serv.	Heat Load	In Serv.	Heat Load
1. Essential Cooling Loop										
CCW pump cooler	2	0.36	2	0.36	2	0.36	1	0.18	2	0.36
RHR heat exchanger	-	-	-	-	2	335.8	-	-	2	92.6
Containment spray pump cooler	2	0.6	2	0.6	2	0.6	-	-	-	-
RHR/LHSI pump cooler	2	0.06	2	0.06	2	0.06	-	-	2	0.06
Auxiliary feedwater pump cooler	2	0.30	2	0.30	2	0.30	2	0.30	2	0.30
Centrifugal charging pump cooler	-	-	-	-	-	-	2	0.17	1	0.08
Safegard chilled water system	-	5.0	1	5.0	1	5.0	1	6.0	1	6.0
Spent fuel pool heat exchanger	1	25.5	-	(6)	-	(6)	1	25.5	1	25.5

TABLE 9.2-6 1
(Sheet 5 of 6)

COMPONENT COOLING WATER TOTAL HEAT LOADS (10^6 Btu/hr) 9
(Westinghouse - 414)

Component	Safety Injection Phase A Isolation		Safety Injection Phase B Isolation		Recirculation		Loss of Power: Hot Shutdown		Loss of Power: Cooldown at 20 hrs.		
	In Serv.	Heat Load	In Serv.	Heat Load	In Serv.	Max Heat Load	In Serv.	Heat Load	In Serv.	Heat Load	1
2. Nonessential cooling loop											
Evaporator concentrate storage tank	-	-	-	-	-	-	-	-	-	-	
Instrument air aftercooler and compressor	1	0.25	-	-	-	-	1	0.25	1	0.25	4
Service air aftercooler and compressor	1	0.20	-	-	-	-	-	-	-	-	
Sample heat exchanger	-	-	-	-	-	-	1	0.22	-	-	9
CFFD sample cooler	-	-	-	-	-	-	1	0.21	-	-	
Boron recycle evaporator package	-	-	-	-	-	-	-	-	-	-	1
High activity waste evaporator package	-	-	-	-	-	-	-	-	-	-	
Low activity waste evaporator package	-	-	-	-	-	-	-	-	-	-	2
Seal water heat exchanger	-	(3)	-	-	-	-	1	2.4	1	2.4	9
Letdown heat exchanger	-	(3)	-	-	-	-	1	20.0	1	6.2	
catalytic recombiner	-	-	-	-	-	-	-	-	-	-	1
Waste gas compressor package	-	-	-	-	-	-	-	-	-	-	
Plant ventilation chillers	3	13.5	-	-	-	-	3	13.5	3	13.5	9

TABLE 9.2-6 1
(Sheet 6 of 6)

COMPONENT COOLING WATER TOTAL HEAT LOADS (10^6 Btu/hr) 9
(Westinghouse - 414)

	Safety Injection Phase A Isolation		Safety Injection Phase B Isolation		Recirculation		Loss of Power: Hot Shutdown		Loss of Power: Cooldown at 20 hrs.		
Component	In Serv.	Heat Load	In Serv.	Heat Load	In Serv.	Max Heat Load	In Serv.	Heat Load	In Serv.	Heat Load	1
Reactor coolant pumps	4	3.0	-	(4)	-	-	-	-	-	-	
Excess letdown heat exchanger	-	(3)	-	-	-	-	-	-	-	-	
Reactor coolant drain collection tank heat exchanger	-	-	-	-	-	-	1	2.23	-	-	
Reactor coolant pump motor air coolers	8	4.0	-	-	-	-	-	-	-	-	4
Total		39.27		6.32		342.12		70.96		147.25	
Total (1)		19.64		5.66		196.06		35.48		73.63	9
Total (2)		38.61		5.66		196.06		70.73		100.59	

Notes:

(1) Total is the heat load per one component cooling water heat exchanger with two 100% trains in operation.

(2) Total is the heat load for one component cooling water heat exchanger assuming single failure criteria (one 100% train in operation).

(3) Assuming component cooling water flow is valved off on "S" signal.

(4) Flow terminated on HI-3 containment pressure ("P" signal)

(5) During normal operation (1) pump is used to cool both trains.

(6) Flow to SFP H/x's is restored (10) hr after phase B isolation, A this time the total heat on CCW system,

TABLE 9.2-6
(Sheet 6a of 6)

COMPONENT COOLING WATER TOTAL HEAT LOADS (10^6 Btu/hr) 9
(Westinghouse - 414)

including load of SF pool is less than at the beginning of recirculation as shown. 9

TABLE 9.2-7
(Sheet 1 of 6) 1

COMPONENT COOLING WATER TOTAL FLOW RATES (gpm) 9
(Westinghouse - 414)

1

Component	Number Provided	Startup No. Cooled	Startup Flow Rate	Normal Oper. No. Cooled	Normal Oper. Flow Rate	Plant Shutdown at 4 hrs. No. Cooled	Plant Shutdown at 4 hrs. Flow Rate	Plant Shutdown at 20 hrs. No. Cooled	Plant Shutdown at 20 hrs. Flow Rate	Refueling No. Cooled	Refueling Flow Rate	
												9
1. Essential Cooling Loop												1
CCW pump cooler	4	4	144	4	144	4	144	4	144	4	144	
RHR heat exchanger	2	1	9000	-	-	2	18,000	2	18,000	2	18,000	9
Containment spray pump cooler	2	(5)	160	2	160	2	160	2	160	2	160	1
SIR/LHSI pump cooler	2	(5)	12	2	12	2	12	2	12	2	12	9
Auxiliary feedwater pump cooler	2	2	60	2	60	2	60	2	60	2	60	1
Centrifugal charging pump cooler	2	(5)	110	2	110	2	110	(5)	110	(5)	110	9
Safeguard chilled water system	2	1	1,000	1	1,000	1	1,000	1	1,000	1	1,000	1 9
Spent fuel pool heat exchanger	2	1	5150	1	5150	1	5150	1	5150	1	5150	1

TABLE 9.2-7
(Sheet 2 of 6)

COMPONENT COOLING WATER TOTAL FLOW RATES (gpm) 9
(Westinghouse - 414) 1

Component	Number Provided	Startup No. Cooled	Startup Flow Rate	Normal Oper. No. Cooled	Normal Oper. Flow Rate	Plant Shutdown at 4 hrs. No. Cooled	Plant Shutdown at 4 hrs. Flow Rate	Plant Shutdown at 20 hrs. No. Cooled	Plant Shutdown at 20 hrs. Flow Rate	Refueling No. Cooled	Refueling Flow Rate	
2. Nonessential Cooling Loop												9 1
Evaporator concentrate storage tank	2	2	8	2	8	2	8	2	8	2	8	
Instrument air aftercooler and compressor	2	1	20	1	20	1	20	1	20	1	20	4
Service air aftercooler and compressor	1	1	75	1	75	1	75	1	75	1	75	
Sample heat exchanger	1	(5)	98	(5)	98	(5)	98	(5)	98	(5)	98	9
GFFD sample cooler		1	28	1	28	1	28	(5)	28	(5)	28	
Boron recycle evaporator package	1	1	780	1	780	1	780	1	780	1	780	1
High activity waste evaporator package	1	1	780	1	780	1	780	1	780	1	780	2
Low activity waste evaporator package	1	1	1000	1	1000	1	1000	1	1000	1	1000	4
Seal water heat exchanger	1	1	372	1	372	1	372	1	372	1	372	9
Letdown heat exchanger	1	1	2083	1	1400	1	2083	1	984	1	984	1
Catalytic recombiners	2	(5)	20	(5)	20	(5)	20	(5)	20	(5)	20	9
Plant ventilation chillers	4	3	2700	3	2700	3	2700	3	2700	3	2700	
Waste gas compressor package	2	(5)	100	(5)	100	(5)	100	(5)	100	(5)	100	1
Reactor coolant pumps	4	4	864	4	864	1	216	(5)	864	-	-	9

 1

TABLE 9.2-7
(Sheet 3 of 6)

COMPONENT COOLING WATER TOTAL FLOW RATES (gpm) 9
(Westinghouse - 414) 1

Component	Number Provided	Startup No. Cooled	Startup Flow Rate	Normal Oper. No. Cooled	Normal Oper. Flow Rate	Plant Shutdown at 4 hrs. No. Cooled	Plant Shutdown at 4 hrs. Flow Rate	Plant Shutdown at 20 hrs. No. Cooled	Plant Shutdown at 20 hrs. Flow Rate	Refueling No. Cooled	Refueling Flow Rate	
												9 1
Excess letdown heat exchanger	1	1	330	(5)	330	(5)	330	(5)	330	(5)	330	9 1
Reactor coolant drain collection tank heat exchange	1	1	225	1	225	(5)	225	1	225	(5)	225	9 4
Reactor coolant pump motor air cooler	8	8	1600	8	1600	8	1600	8	1600	8	1600	
Total			26,719		17,036		35,071		34,620		33,754	9
Total (1)			13,360		- (7)		18,036		17,810		17,378	
Total (2)			25,080		17,036		25,114		23,661		23,749	

TABLE 9.2-7
(Sheet 4 of 6)

COMPONENT COOLING WATER TOTAL FLOW RATES (gpm)
(Westinghouse - 414)

	Component	Safety Injection Phase A Isolation		Safety Injection Phase B Isolation		Recirculation		Loss of Power Hot Shutdown		Loss of Power Cooldown at 20 hrs.		
		No. Cooled	Flow Rate	No. Cooled	Flow Rate	No. Cooled	Max Flow Rate	No. Cooled	Flow Rate	No. Cooled	Flow Rate	
1.	Essential Cooling Loop											
	CCW pump cooler	4	144	4	144	4	144	4	144	4	144	
	FHR heat exchanger	-	-	-	-	(6)	16,800	-	-	2	18,000	9
	Containment spray pump cooler	2	160	2	160	2	160	2	160	2	160	1
	FHR/IHSI pump cooler	2	12	2	12	2	12	2	12	2	12	9
	Auxiliary feedwater pump cooler	2	60	2	60	2	60	2	60	2	60	1
	Centrifugal charging pump cooler	2	110	2	110	-	-	2	110	(5)	110	9
	Safeguard chilled water system	1	1000	1	1000	1	1000	1	1000	1	1000	1 9
	Spent fuel pool heat exchanger	1	5150	-	-	-	-	1	5150	-	5150	1

TABLE 9.2-7 1
(Sheet 5 of 6)

COMPONENT COOLING WATER TOTAL FLOW RATES (gpm) 9
(Westinghouse - 414)

	Safety Injection Phase A Isolation		Safety Injection Phase B Isolation		Recirculation		Loss of Power: Hot Shutdown		Loss of Power: Cooldown at 20 hrs.		
Component	No. Cooled	Flow Rate	No. Cooled	Flow Rate	No. Cooled	Max Flow Rate	No. Cooled	Flow Rate	No. Cooled	Flow Rate	1
2. Nonessential cooling loop											
Evaporator concentrates storage tank	2	8	-	-	-	-	2	8	2	8	
Instrument and service air aftercoolers	1	20	-	-	-	-	1	20	1	20	4
Service air aftercooler and compressor	1	75	-	-	-	-	1	75	1	75	
Sample heat exchanger	1	(3)	-	-	-	-	(5)	98	(5)	98	9
GFFD sample cooler	-	(3)	-	-	-	-	1	28	1	28	
Boron recycle evaporator package	-	(3)	-	-	-	-	(5)	780	1	780	1 9
High activity waste evaporator package	-	(3)	-	-	-	-	(5)	780	1	780	2 9 2
Low activity waste evaporator package	1	1000	-	-	-	-	1	1000	1	1000	4
Seal water heat exchanger	-	(3)	-	-	-	-	1	372	1	372	9
Letdown heat exchanger	-	(3)	-	-	-	-	1	1400	1	984	
~~Radwaste hydrogen recombiner PKG~~	-	(3)	-	-	-	-	(5)	20	(5)	20	1 9
Waste gas compressor package	-	(3)	-	-	-	-	(5)	100	(5)	100	1 9
Plant ventilation chillers	3	2700	-	(4)	-	-	3	2700	3	2700	

 1

TABLE 9.2-7
(Sheet 6 of 6)

COMPONENT COOLING WATER TOTAL FLOW RATES (gpm) 9
(Westinghouse - 414)

Component	Safety Injection Phase A Isolation		Safety Injection Phase B Isolation		Recirculation		Loss of Power Hot Shutdown		Loss of Power Cooldown at 20 hrs.		
	No. Cooled	Flow Rate	No. Cooled	Flow Rate	No. Cooled	Max Flow Rate	No. Cooled	Flow Rate	No. Cooled	Flow Rate	1
Reactor coolant pumps	4	864	-	-	-	-	(5)	864	(5)	864	9 1
Excess letdown heat exchanger	-	(3)	-	-	-	-	-	-	(5)	320	9
Reactor coolant drain collection tank heat exchanger	-	(3)	-	-	-	-	1	225	1	225	1
Reactor coolant pump motor air cooler	8	1000	-	-	-	-	8	1600	8	1600	2
Total		12,903		3,086		18,176		16,706		26,420	9
Total(1)		6,452		1,543		9,088		8,353		18,210	
Total(2)		12,156		2,338		9,588		15,921		23,181	

Notes: 1

(1) Total is the required flow per component cooling water pump with two trains in operation.

(2) Total is the required flow for one component cooling water pump assuming single failure criteria (one train in operation).

(3) Assuming component cooling water is valved off on "S" signal.

(4) Flow terminated on HI-3 containment pressure ("P" signal) 9

(5) Cooling flow maintained to components not is service.

(6) Flow used in P-T Analysis.

TABLE 9.2-7
(Sheet 6a of 6)

COMPONENT COOLING WATER TOTAL FLOW RATES (gpm) | 9
(Westinghouse - 414)

(7) During normal operation (1) pump is used to supply both trains. | 9

TABLE 9.2-8
(Sheet 1 of 3)

COMPONENT COOLING WATER SYSTEM DESIGN PARAMETERS

1. CCWS Heat Exchanger

Quantity	two		
Type	Straight tube & shell		
Maximum heat transferred, Btu/hr	196.06 x 10^6 (1)		9
	Shell Side	**Tube Side**	
Fluid	component water	service water	
Maximum inlet temperature, F	160	100 (3)	9
Maximum outlet temperature, F	120 (2)	147	9
Maximum flow rate, gpm	25,114 (4)	15,000 (4)	9
Design temperature, F	225	225	
Design pressure, psig	150	150	
Design code	ASME III	ASME III	
Safety Class	3	3	
Seismic Category	I	I	

TABLE 9.2-8
(Sheet 2 of 3)

COMPONENT COOLING WATER SYSTEM DESIGN PARAMETERS

2. CCWS Pumps

Quantity	four	
Type	horizontal, centrifugal	
Fluid pump	CCW	
Design flow rate, gpm	26,000	| 9
Design head (TDH), ft	240	
Design temperature, F	200	
Motor size, Bhp	2000	| 1
Design code	ASME III	
Safety Class	3	
Seismic Category	I	
Available NPSH	60 feet	
Seal cooling water	component cooling water	
Pump cooler flow rate, gpm	36	| 9

TABLE 9.2-8
(Sheet 3 of 3)

COMPONENT COOLING WATER SYSTEM DESIGN PARAMETERS

3. CCWS Surge Tank

Quantity	one
Capacity, gal	4700 (total) 2350 (per partition)
Design temperature, F	225
Design pressure, psig	25(5) 9
Design code	ASME III
Safety Class	3
Seismic Category	I

1. This is the maximum expected heat load and is postulated to occur during initial recirculation after a LOCA with only one heat exchanger in operation after single failure. 9

2. This is the maximum expected CCWS outlet temperature and is postulated to occur during the first 4 hours of recirculation after a LOCA. Under normal plant operation, the expected component cooling water temperature at the outlet of the heat exchanger is 65 F min. and 105 F max.

3. The table is based on the assumption that site water is available at 100 F. However, the CCWS is designed to accommodate a range of inlet service water temperatures. 9

4. This is the maximum expected flow rate during the plant shutdown at 4 hours when cooling flow is maintained to components not in service, postulating a single failure. 9

5. Design of the tank partition allows for one section of tank filled with water while the other section is empty.

b) Storage Areas for Ion Exchange Resins

Unused ion exchange resins are not stored in areas which contain or expose safety related equipment.

c) Hazardous Chemicals

Hazardous chemicals are addressed in the Utility/Applicant's SAR. 8

d) Materials Containing Radioactivity

Materials which collect and contain radioactivity such as spent ion exchange resins, charcoal filters, and HEPA filters are stored in closed metal tanks located in areas which are free of ignition sources. Due to their potential hazard these areas are separated and enclosed by 3 hour fire barriers.

9.5.2 Communication Systems

9.5.2.1 Design Bases

Intraplant and plant-to-offsite communication systems are provided among the plant buildings, switchyard, and the public telephone system. Telephones, public address speakers, and handsets are conveniently located to permit effective communications between personnel during normal operation, maintenance periods, startup operation, shutdown, and refueling of the plant. A two-way portable radio system is also provided for use by the fire brigade and other operations personnel 9
required to achieve safe plant shutdown.

Sound-powered telephone systems, independent of all external power sources, are provided in critical areas as a backup to the public address systems. These diverse means of communication are physically independent to prevent loss of all systems as a result of a single failure. Diverse capabilities for plant-to-offsite emergency communications with public safety agencies are 9
provided. An emergency alarm system is installed which provides a unique alarm signal to ensure personnel evacuation.

9.5.2.2 System Description

Detailed description and drawings will be provided in the Utility Applicant's SAR. The intraplant and plant-to-offsite communication systems consist of the following systems:

a. Public Address System

The public address system provides separate channels for paging and party lines to permit communication throughout the entire plant including the main office and control room. The system also permits two-way communication between two or more locations vital to the operation of the plant and the safety of personnel. The page-party line loudspeakers are powered by individual amplifiers and power to this system is supplied from a source which is available upon loss of offsite power. The voice-paging channel output is clearly audible above the highest expected 9
noise levels under both normal and accident conditions. Separate and independent party lines permit communications between handsets only, thereby making the page channel available to others.

Three party lines are supplied in addition to the page channel. All three lines are available at each handset location (except in 9

elevat rs). A page-party line (with only one party line) handset station is installed in each elevator to permit communication in an emergency situation. Selection of a desired channel is achieved by means of a multiposition switch provided as part of each handset station. Both the page channel and the party line channels, which are independent, may be used simultaneously without interference. 9

b. Intraplant Telephone System

An independent private automatic branch exchange (PABX) dial telephone system is used for uninterrupted private communications between plant areas that are routinely occupied. It also serves areas vital to plant operation, which may be occupied on a nonroutine basis during certain modes of plant operation, such as fuel building, control rod drive equipment area, hot shutdown panel area, switchyard, and the intake structure of the service water system.

The PABX telephone system is integrated with the public address page-party system through an isolating device to ensure that a single failure in either one of these two systems does not affect safe and reliable operation of the other system. Power is supplied to the PABX telephone system from a source which is available upon loss of offsite power. Also, if the PABX telephone system's normal ac power supply is lost, a telephone station in the control room, the hot shutdown panel A and B rooms and in the security central alarm station remains operable by deriving its power from the public telephone system.

The PABX telephone system is connected to the public telephone system by trunk lines. 9

c. Intraplant Sound-Powered Telephone System

A sound-powered telephone system, independent of all other systems and external power sources, is provided in critical areas to serve two purposes: to provide communications and serve as a backup to the public address page-party system, and to provide uninterruptible communication channels for maintenance, calibration, testing, and refueling activities. All sound powered telephone cables are routed in conduits reserved only for that function.

This system consists of three subsystems as follows:

Subsystem One: Maintenance Loops - Consists of a two channel hard-wired communication link between the control area and critical plant areas.

Subsystem Two: Refueling Loops - Consists of a two-channel hard-wired communication link between the the Control Room area, fuel handling area, and reactor operating floor. This subsystem is primarily provided for refueling

operation. One channel of the refueling loop will be used primarily for refueling operations while the second channel will be used for maintenance, calibration, and testing purposes. Subsystems one and two share the same conduit system.

Subsystem Three: Emergency Loops - Consists of a two-channel hard-wired communication link between the hot shutdown panels and safety-related equipment areas. This system is primarily provided for communications in the unlikely event that the Control Room becomes inaccessible.

Each emergency loop channel is routed in its own conduit system. No other systems, sound powered or otherwise, share these conduits.

The headset jack stations are conveniently located on panels in the Control Room and in critical areas.

Communication can be established between the Control Room and any local panel or between two local panels by suitably plugging the headsets into jack stations which are mounted either in the panel or nearby. This system provides standby communication capability and does not depend on external sources of power other than the human voice. 9

The number and location of sound-powered telephone system receptacles are adequate to bring the plant to a hot shutdown or a cold shutdown from the Control Room or from the hot shutdown panel and other areas. The sound-powered telephone system can be used as a backup to the public address page-party system in the critical equipment areas of the plant. One independent howler loop per unit is provided for sound-powered signaling purposes.

d. Intraplant Portable Radio Transmitter-Receiver System

Two separate communication channels of unique wavelengths for the operating personnel, maintenance personnel, and fire fighting squad are provided to enable two-way radio voice communication between the Control Room and various plant buildings. The Control Room is equipped with the hand-held transmitter-receivers. Portable transmitter-receivers operating on either one or both channels are provided for use by operations, maintenance, and fire fighting personnel for communication between various areas of the plant, required to

achieve safe plant shutdown. This system does not interfere with the communications capability of the plant security force.

To improve reception from various plant buildings, fixed repeaters, coaxial slotted cables, or both, are installed as required in these buildings. The fixed repeaters are protected from exposure fire damage, to the greatest extent practicable.

The use of switchyard remote supervisory carrier current equipment is discussed in the Utility-Applicant's SAR. The portable radio carrier frequencies will not interfere with such equipment.

The portable radio communication is designed so as not to affect the actuation of protective relays.

e. Offsite Communication Systems

Two diverse methods of plant-to-offsite communication are provided:

1) Public telephone system 9

2) Two-Way Radio System

The intraplant telephone system is directly connected to the public telephone system; each plant telephone is available for offsite communication.

A two-way radio transmitter-receiver system is also provided for emergency communication between plant and offsite public safety agencies. It can be operated from the control room, remote hot shutdown panel A and panel B rooms and from the guardhouse.

This two-way radio is described in the security plan.

The two-way radio system and telephone system are independent, and provide reliable plant-to-offsite communication. A failure of one system does not result in complete loss of offsite communications.

f. Emergency Evacuation Alarm System

The evacuation alarm is generated by a solid state multifrequency audio oscillator capable of producing five distinctive tones which can be heard over all plant paging zones via the public

address page-party system. One of the distinctive tones, which satisfies the NRC Regulatory Guide 8.5 requirements, is designated for the evacuation alarm signal.

The evacuation alarm system, including the multifrequency audio oscillator, is powered by a source available upon loss of offsite power and provides a unique alarm signal to ensure personnel evacuation in case of an emergency. The alarm is initiated by the Control Room operator in the event of a plantsite evacuation emergency.

9.5.2.3 Evaluation

The following evaluation is intended to establish the adequacy and redundancy of the plant communication system design:

a. Intraplant Systems

Each intraplant system, i.e., the public address page-party system, PABX telephone system, sound-powered telephone system, and portable radio transmitter-receiver system, is designed to provide the required intraplant communications during and after accident conditions as well as for plant operation fire fighting and maintenance purposes. Failure of any one of the above systems does not result in a failure of any other system. The power supply for the PABX telephone system is provided from the on-ESF bus. Upon loss of total ac power to the PABX telephone system, a telephone in the control room, the hot shutdown panel A and B rooms and in the security central alarm station remains operable by deriving power from the public telephone system. Power supply for the public address page-party system is provided from a source available upon loss of offsite power. The PABX telephone and public address systems are connected through an amplifier device which acts as an isolating device. This ensures that any single failure in any one of these two systems does not result in a failure of the other system. The public address page-party system handsets and speakers are conveniently located to cover all critical areas. Each area of the plant is served by a separate public address page-party system cirucit to confine the system outage to the area the faulty circuit serves. 9

The sound-powered telephone system is independent of all external power sources and its headset jack stations are conveniently located throughout the plant. This system can be employed as a backup to the public address page-party system in critical equipment areas of the plant. In addition, redundant components

and cabling in the sound-powered telephone system are separated to prevent failure of both systems beause of a single failure.

The intraplant portable radio transmitter-receiver system is powered by rechargeable batteries and has two redundant channels. This system can be employed as a backup to the public address page-party and sound powered systems in case of emergency, or if a communication line or trunk is severed, as a result of an accident.

b. Plant-to-Offsite Systems

There are two independent plant-to-offsite communication systems available for the use of Control Room operators. The availability of these systems during and after the accident condition is enhanced by the fact that each enters the plant via different means. 9

The public telephone lines (trunk lines) are connected to the plant PABX telephone system. This extends the use of public telephone lines throughout the plant.

The plant-to-offsite two-way radio communication system can be used as a backup to the public telephone system. This provides communication between the plant operator and public safety agencies. The power to this system is provided from a source available upon loss of offsite power. Also, there is an inherent redundancy in this system since it has two separate communication channels.

9

9.5.2.4 Inspection and Test Requirements

At the completion of installation, all communication systems are inspected, tested, and adjusted (if required) to ensure proper 1
coverage and audibility under the maximum plant noise levels during the various operating conditions, including the accident 9
condition.

Since the communication systems (except the sound-powered telephone and offsite two-way radio systems) are used on a daily basis, periodic testing is not required. Periodic testing of the sound-powered telephone and offsite two-way radio systems are 9
scheduled to ensure their operability. Preoperational and periodic testing demonstrate that the frequencies used for portable radio communication do not affect the actuation of protective relays.

Periodic testing of the emergency evacuation alarm signal is in accordance with ANSI N2.3-1967, Immediate Evacuation Signal for Use in Industrial Installations Where Radiation May Occur.

A stock of spare parts is kept on the site for those components of the various communications systems that can be readily 9
repaired by the plant personnel.

9.5.3 Lighting Systems

9.5.3.1 Normal Lighting System

Normal lighting for the plant buildings is supplied by a grounded, 208/120-V, three-phase, four-wire distribution system. Dry-type transformers, rated at 480-208/120-V, are connected to 480-V non-safety related motor control centers throughout the plant. These transformers supply independent lighting panels 9
which are conveniently located throughout the plant to permit efficient distribution of the lighting load. A 480-V distribution system is used for roadway lighting

Emergency interior and exterior lighting uses a 9
208/120-V system, similar to the system described in the preceding paragraph, as well as a 480-V system for security 9
lighting with connections to the non-safety-related diesel generator.

System design is equal to, or exceeds, the requirements of IFS Lighting Handbook (5th edition). Illumination sources containing mercury, such as flourescent, mercury vapor, metal halide or high pressure sodium lamps are not used in areas where they are restricted such as in the containment, waste processing area, and portions of the fuel handling area, safeguards area, auxiliary area and turbine building; incandescent or quartz iodine type fixtures are provided in these areas. When necessary, means are provided in floor drains to preclude mercury 9
contamination of the radioactive waste processing system. If mercury or iodine in a lamp becomes activated, it is disposed through the radioactive waste processing system.

9.5.3.2 Emergency Lighting System

AC and dc emergency, reduced level, lighting is provided in locations where safety-related functions are performed or where personnel safety is involved. These areas include:

a. Control room

b. Diesel generator rooms

c. Battery rooms

d. Hot shutdown panel location 9

e. Safety-related equipment locations

f. Hazardous areas

g. Primary access routes to and from the preceding areas, fire areas and primary exits

The ac-emergency lighting system consists of certain lighting fixtures that are part of and are powered from the normal power system; in the event of loss of offsite power, only these ac-emergency lighting fixtures are automatically connected to the 9
non-saftey-related diesel generator. Power is available to these lights as soon as the diesel generator has achieved rated voltage and frequency and has been connected to the distribution system.

As a backup to the ac-emergency lighting system an independent dc-emergency, low level lighting system is provided in critical plant areas. The dc system, consisting of central battery fed lights and individual battery pack units, is automatically and immediately energized upon loss of ac power and automatically

deenergized upon restoration of ac power. The most crucial areas, such as the control room, major remote shutdown areas and vital access routes between them have lights energized from the non-Class IF station battery. In addition, these areas, as well as all areas that must be manned for safe shutdown and the access and egress routes between them and between all fire areas incorporate fixed, self-contained lighting consisting of sealed-beam or, where not restricted fluorescent units, with individual eight-hour minimum battery power supplies. Safe shutdown areas include those required to be manned if the control room must be evacuated. When remote sealed beam heads are used they are located in the same fire area as the battery pack that energizes them. Each battery pack unit contains an individual battery and an integral automatic charger.

Exit lights are energized from the ac-emergency lighting system with dc-emergency lighting provided nearby. Phosphorescent, 9
non-electric exit and directional signs are used where required. Suitable sealed-beam, battery-powered portable hand lights are provided for emergency use by the fire brigade and other personnel required to achieve safe plant shutdown. These units and spare batteries are located at strategic locations throughout the plant. Security lighting is discussed in the plant security plan.

9.5.3.3 Failure Analysis

Since the dc and ac lighting systems are independent, a failure in one system does not cuase the other system to cease functioning. A restraining cable is used on each lighting fixture near safety related equipment inside critical plant areas which could become falling objects.

9.5.3.4 Inspection and Testing 9

The ac and dc emergency lighting systems and battery packs are inspected and tested periodically to assure availability at all times. A regular program of periodic battery replacement is followed to assure reliable operation of the fixed battery packs and portable hand lights. Sealed beam lamps are periodically cleaned to assure maximum output and sufficient replacements are stocked at all times in the plant.

9.5.4 Emergency Diesel Generator Fuel Oil Storage and Transfer System

The function of the emergency generator fuel oil storage and transfer system, shown in Figure 9.5-2, is to supply fuel oil to the emergency diesel generators. Table 9.5-1 lists the design parameters of the components.

9.5.4.1 Design Bases

The system is partially housed in seismic Category I structures and partially installed underground. It is protected from natural phenomena and external missiles. Components installed underground are designed to operate submerged. Protection from the effects of breaks in high- and moderate-energy piping is in accordance with BTP APCSB3-1 and MEB 3-1. The diesel oil storage tank pit and missile shield is shown in Figure 9.5-3.

Underground components are protected from corrosion by a bitumastic coating similar to that specified in AWWA C203-66.

The principal components of the emergency diesel generator fuel oil system are one diesel engine fuel oil storage tank, one fuel oil transfer pump, and one fuel oil day tank for each emergency diesel generator.

The emergency diesel generator fuel oil storage tanks are sized to store sufficient supply of diesel oil for 7 days continuous operation of its associated emergency diesel generator system under maximum rated load conditions. Rated load definition is in accordance with IEEE 308-74. Diesel fuel is transferred from the diesel engine fuel oil storage tank to the fuel oil day tank by the fuel oil transfer pump. Each pump discharge line contains a strainer to minimize the transfer of solids to the day tanks. Both the storage tank and the day tank are separately vented to the atmosphere and equipped with flame arresters.

The fuel oil day tanks are designed in accordance with NFPA 37 and are sized to provide sufficient fuel to operate the diesel generator for 4 hours. Each diesel generator fuel oil system is separate, and there are no shared subsystems or components. The system is designed in accordance with ASME B&PV Code, Section III, Class 3, and seismic Category I. Applicable quality assurance standards are presented in subsection 3.2.2. Component design permits adequate inspection, cleaning, maintenance, and repairs.

Essential portions of the system are housed within seismic Category I structures and are protected from the effects of pipe whip or jet impingement from high- and moderate-energy pipe breaks.

d. Instrumentation for monitoring, the standby status and performance of the system is provided in the control room, as described in subsection 7.3.1.1,g.

e. Emergency diesel generator air starting compressor is located inside the auxiliary building and is not affected by the design maximum flood, tornado or tornado missiles.

Emergency diesel generator air starting compressor, air receiver, | 6
and design parameters are to be specified by a diesel generator manufacturer.

Failure mode and effect analysis for the emergency diesel generator air starting system are shown in Table 9.5-5.

9.5.7 Diesel Engine Lubrication System

Each diesel engine lubrication system is designed to provide adequate engine lubrication under all operating conditions, including full-load operation. The system is internal to the diesel engine. The flow diagram and the system design parameters will be presented by the diesel engine vendor.

The design bases and safety provisions for the diesel engine are: | 9

a. The lubrication of the diesel engine is performed adequately.

b. The redundant diesel engine lubrication systems are separated and do not share any components in accordance with the requirements of 10 CFR Part 50, Appendix A, General Design Criterion 5. | 9

c. System abnormal operation is detected and alarmed in the control room. In case of malfunctioning, the operator can switch to the redundant diesel generator.

d. Diesel engine protection devices are bypassed in the event of emergency operation as discussed in Section 8.3.1.1c. | 9

e. Periodic tests, described in Chapter 16.0 are made to ensure the quality of lubricating oil. 9 1

f. The diesel engine lubrication system is located inside the auxiliary building and is not affected by the design maximum flood, tornado or tornado missiles in accordance with the requirements of 10 CFR Part 50, Appendix A, General Design Criteria 2 and 4. Failure of a non-seismic Category I structure or component will not affect the safety related function of the system. 9

g. The diesel engine lubrication system is classified as ANSI Safety Class 3 and designed to seismic category I requirements. System components will be desiged to comply with the ASME B&PV Code, Section III, class 3. However, when a component is commercially unavailable as ASME Class 3 design, the component will be designed, fabricated, erected, and tested to quality standards commensurate with the safety function to be performed. 9

h. The temperature of the oil is automatically maintained above a minimum value by means of an independent recirculation loop including its over pump and heater, to enhance the diesel and starting reliability in the standby condition.

9.5.8 Diesel Generator Combustion Air Intake and Exhaust System

The emergency diesel generator combustion air intake and exhaust system supplies combustion air of reliable quality and sufficient quantity to the diesel engines, and exhausts the products of combustion from the diesel engine to the atmosphere and is shown in Figure 9.5-6.

9.5.8.1 Design Bases

a. The redundant emergency diesel generator combustion air intake and exhaust systems are separated and do not share any components.

b. The essential portions of the system are housed in a seismic Category I structure and are protected from flood, tornado or tornado missiles. Components have sufficient separation or shielding to protect the system from missiles and from pipe whip and jet impingement caused by cracks or breaks in high- and moderate-energy piping.

c. The Diesel Generator Air Intake and Exhaust System is classified as ANSI Safety Class 3 and designed to Seismic Category I requirements. System components will be designed to 9 comply with the ASME B&PV Code, Section III, Class 3. However, when a component is commerically unavailable as ASME Class 3 design, the component will be of the highest commercial quality available from the chosen manufacturer.

9.5.8.2 System Description

The emergency diesel generator combustion air intake and exhaust system consists of an intake pipe that brings outside combustion air and an exhaust pipe that discharges combustion gases to the environment. Both intake and exhaust pipes are designed for maximum diesel generator ratings and for continuous operation.

TABLE 10.3-2

TYPICAL MATERIALS USED FOR MAIN STEAM AND FEEDWATER SYSTEM COMPONENTS

Components and Material Piping	Material Specification*
Carbon Steel	SA106 GR B SA333 Grade 6 SA672
Fittings, Flanges and Connections	
Carbon Steel	SA105 SA350 LF2 SA420 GRWPL6
Valves	
Carbon Steel	SA105 SA216 WCB
Bolting Studs	SA193 GR B7
Nuts	SA194 GR 2H
Welding Material	
Ferritic	SFA 5.1 SFA 5.2 SFA 5.5 SFA 5.17 SFA 5.18 SFA 5.20

* When components are non-nuclear safety related and fabricated to ANSI B31.1, the corresponding ASTM "A" materials designation may be substituted for the ASME "SA" designations. Similiarly, the AWS "A" designation may be substituted for the corresponding ASME "SFA" welding materials designations.

9

The auxiliary feedwater system also supplies auxiliary feedwater to the steam generators during other modes of plant operation such as the following:

a. The auxiliary feedwater system maintains the proper water level in the steam generators during cold startup operation. The pumps supply feedwater until sufficient steam can be generated to operate the main feedwater pump turbines.

b. When the reactor is maintained in the hot shutdown condition for an extended period of time, the small amount of feedwater flow necessary to maintain the steam generators water inventory may be switched from the main feedwater pumps to the auxiliary feedwater system.

10.4.9.2 System Description

a. General

The auxiliary feedwater system flow diagram is shown in Figure 10.4-3. The system includes an adequate storage of feed quality water, and adequate pumping capacity to supply the steam generators, and system piping.

The system supplies water to the steam generators where it is converted into steam by the heat transferred from the primary coolant which removes decay heat from the reactor core. A portion of the generated steam is used in powering the auxiliary feedwater pump turbine. The remaining steam is dumped to the condenser or released to the atmosphere through the power-operated relief valves or the main steam safety valves.

A safety class auxiliary feedwater storage tank provides storage
of deaerated feed quality water for immediate use. This amount 6
of water is sufficient to maintain the plant for 4 hours at hot 9
standby, then cool the primary system at an average rate of 50 F 6
per hour down to 350 F hot leg temperature and 400 psig in
5 hours at which time the RHR system is capable of operation. 9

A floating diaphragm arrangement in the tank prevents air leakage into the liquid. The stainless steel tank is not corroded by deaerated demineralized water.

One supply line from the auxiliary feedwater tank supplies two electric-motor-driven pumps and turbine-driven pump. Backup
source is station service water under all conditions described in 6
Table 9.4-4. The alternate backup is the condensate storage

tank. All pumps are located in the auxiliary building, which is designed to Seismic Category I requirements. 6

TABLE 10.4-4
AUXILIARY FEEDWATER SYSTEM REQUIREMENTS
(WESTINGHOUSE -414)
(Sheet 1 of 2

The interface requirements of RESAR-414 Section 6.6 are satisfied as follows:

a. An auxiliary FW system is provided to ensure a source of SG feedwater.

b. AFW is required during startup, shutdown, hot standby and emergency conditions. 6

c. The system is Safety Class 2 and 3, Seismic Category I and meets the requirements of GDC 34. See Section 10.4.9.1 par. e.

d. Utilization of multitrain power sources is discussed in Section 10.4.9.3 and Table 10.4-2. System actuation logic is discussed in Chapter 7.

e. System design parameters such as flow, maximum allowable flow delivery time and temperature are complied with and listed in Table 10.4-3.

f. Sufficient source of auxiliary FW for hot standby is specified in Section 10.4.9.2 Provision for long term redundant sources of water is described in Section 10.4.9.3. 9

g. The automatic actuation of pumps and subsequent isolation of the SG blowdown and sampling systems is discussed in Section 10.4.9.5.

h. The system functions within the SG pressure range defined by the pressure at operating conditions down to 100 psia. 6

i. Sufficient auxiliary feedwater is available under any accident conditions to enable the plant to be taken to a safe condition. It is provided as a backup to the normal feedwater system and as a means for removing core residual heat in the event of a LOCA for small breaks.

j. The AFW system provide the primary means of feedwater addition to the SG in the event the control room becomes

TABLE 10.4-4
AUXILIARY FEEDWATER SYSTEM REQUIREMENTS
(WESTINGHOUSE -414)
(Sheet 2 of 2)

inaccessible. Necessary instrumentation and controls are provided in the hot-shutdown panels. 6

k. Sufficient redundancy is provided in the AFW system to supply the required flow, while subjected to a single active failure in the short term-less than 24 hours. The system is also available during long term periods when the main feedwater system is out of operation. In the later case the system is designed to sustain a single active or passive failure.

l. The volume of condensate quality water is 290,000 gallons to maintain the plant for (4) hours at hot standby followed by cooldown at average rate of 50 deg F/hr for (5) hours. 9

m. Instrumentation requirements and conformance with GDC 19 are presented in Section 10.4.9.5.

n. The AFW system is not connected directly to the S.G. See Figure 10.4-3. However, all components and piping from the Containment isolation valves to the steam generator feedwater nozzles are designed in accordance with ASME III, Class 2. 6

o. The primary and secondary control of the system is described in Section 10.4.9.5.

11.4 Solid Waste Management System

11.4.1 Design Bases

The solid waste management system is designed to receive, solidify, package, and temporarily store evaporator concentrates, spent demineralizer resin, RO system concentrates, spent filter cartridge assemblies, and chemical drain tank contents for transportation to, and disposal at, licensed radioactive waste burial sites. Equipment is also provided for compacting and packaging low-radiation-level miscellaneous solid compressible wastes that result from plant operations and maintenance. The radioactive waste packages from this system conform by design to the requirements of 10 CFR Parts 20, 50, and 71 and of United States Department of Transportation (DOT) 49 CFR Parts 170-178. Compliance with NRC, DOT, and state regulations is determined according to radioactivity measurement and the amount of waste processed. If radioactive levels are too high, corrective action is taken either by permitting radioactive decay dilution or by shielding. 9

The design objectives of the solid-waste management system include the following:

a. To provide a means of solidifying radioactive liquids and encapsulating or compacting radioactive solid wastes generated by reactor plant operations 2

b. To provide adequate equipment and storage area shielding for the protection of operating personnel pending shipment of waste to disposal facilities

c. To measure and record the radiation levels of the solid waste processed for shipment from the site to disposal facilities

d. To provide a 3- to 6-month storage capacity for the processed wastes depending upon plant operation 2

Section 3.2 indicates the seismic design classification of the structure housing the solid-waste management system. The solid waste management system is not safety-related and is classified as nonnuclear safety (NNS).

9

Volumes and activity levels of the solid wastes are presented in Tables 11.4-1 through 11.4-4. Isotopic inventories for all waste categories have not been presented. Compressible waste isotopic inventories and miscellaneous dry wastes such as tools are not 2

identifiable because of the uncertainty of transport mechanisms, absorption, and so forth, and therefore the total activity expected is based on operating plant experience is presented, however, the Utility/Applicant shall make filter replacement on a shielding criteria of maximum contact dose rate. 2

The solid waste management system is designed in accordance with the criteria presented in Branch Technical Position ETSB11.3. For information regarding the waste solidification portion of the solid waste management system, refer to the U/A SAR. 9

2

11.4.2 System Description

11.4.2.1 General

Figures 11.4-1 and 11.4-2 indicate major flow paths and equipment 2
for the solid-waste processing system.

9

Processes of the system are the following:

a. Solidification Process

The waste solidification package process description is addressed 9
in the Utility Applicant's SAR

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9

9

b. Waste From Spent Resin

The spent resin sluice portion of the solid waste processing system consists of a spent resin storage tank, sluice pump, and sluice filter. The equipment is arranged so that the resin sluice water, after entering a demineralizer vessel, is returned
to the spent resin storage tank for reuse. The system is 2
designed to transport spent resin to the spent resin storage tank without generating large volumes of liquid waste. This is accomplished by reusing the sluice water for subsequent resin sluicing operations.

c. Expended Filter Cartridge Handling

Expended filter cartridges are removed for disposal by means of a filter transfer cask. The transfer cask is shielded to reduce operating personnel exposure.

d. Compactor Operation

The compaction process involves the use of standard 55-gallon drums. The compactor is equipped with a dust shroud to prevent escape of radioactive particulate during the compaction process. The shroud is connected to the building exhaust system. After the drum has been filled with compacted waste, it is sealed and transferred to the storage area.

e. Miscellaneous Contaminated Component Handling 2

Large contaminated equipment and components are handled on a case-by-case basis. Components are decontaminated, wrapped by a waterproof membrane, and crated for structural support and handling before being transported, by licensed carrier, to an offsite burial ground.

11.4.2.2 Component Descriptions

Table 11.4-5 lists Solid Waste Management System component 2
parameters

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2

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11.4.2.3 Operating Procedures

a. Waste Solidification Operation

Operation of the waste solidification package is addressed in the Utility Applicant's SAR 9

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9

b. Spent Resin Handling

This part of the waste processing system sluices resin from the demineralizers and transports resin from the spent resin storage tank to the waste solidification plant.

1) Resin Sluicing

Before resin sluicing begins, the demineralizer is
valved out of service and the flow path aligned from the
resin sluice pump through the process line of the
demineralizer, through the screen at the top of the
demineralizer, and back to the spent resin storage tank. 2
The resin sluice pump provides flush water for loosening
the bed for sluicing. After approximately 10 minutes of
back-flushing, the pump is shut off and the valve in the
back-flush circuit is closed. The sluice line is
opened, and the resin sluice pump is restarted. The
resin then flows to the spent resin storage tank. After
the resin sluice pump is shut off, fresh resin is added
via the resin fill line and the valve is closed.

The flow path is now aligned in the same manner as for resin flushing, e.g., through the process line, through the screen at the top of the demineralizer, and back to the spent resin storage tank. The pump is then started to remove resin fines, should any remain. The valves are then realigned for normal process operation. At no time are the resins sluiced through the spent resin sluice pump.

2) Resin Transfer To Solidification System

When sufficient spent resin has been accumulated in the
spent resin storage tank, the valves in the line to the
waste solidification package are opened and all other 9
valves are closed. The tank is then pressurized with
nitrogen. The solidification package valves are then 2
opened and the resin is transferred. During transfer,
nitrogen is forced through the spargers in the tank 9

bottom to level the resin and maintain the tank pressure. When transfer to the waste solidification package is completed, the transfer valves are closed and the tank pressure is relieved to the plant vent. The transfer valves are then flushed. 9

c. Expended Filter Cartridge Assembly Processing Operation

The filter transfer cask is used to remove and dispose of radioactive spent filter cartridge assemblies in the following manner:

1) To change the filter, it is first valved out of service, vented and drained.

2) The filter transfer cask is positioned alongside the filter compartment concrete shield plug. The shield plug is lifted and placed down beyond the work perimeter. 2

3) The filter housing bolts are disengaged, and the filter housing head is moved to allow removal of the expended filter cartridge assembly.

4) The filter transfer cask is moved until the centerline of the cask is aligned with the centerline of the expended filter cartridge assembly.

5) The filter transfer cask shielded base is removed and the hoist lowered to engage the cartridge assembly.

6) The grappled cartridge assembly is then raised into the shield cavity, and the shield base secured to contain any liquid or particulate that may drip during transit.

7) A monorail is used to move the filter transfer cask to the hatchway, through which the cask is lowered to the filter loading area.

8) The filter transfer cask is lowered until it is positioned above a disposable container. 9

9) When centered above the container opening, the contained expended filter cartridge assembly is lowered into the disposable container. The filter transfer cask is then decontaminated by allowing the decontamination water to enter the container.

10) The container is then moved to the fill area for solidification 9

d. Compactor Operation 2

The compactor is used to compress low-radiation-level solid waste such as paper, disposable clothing, rags, towels, floor coverings, shoecovers, plastics, and respirator filters into drums. Compressible solid wastes are placed into the drums manually. The drum is placed on the drum support plate located at the front of the compactor and is centered by adjustable drum-locating pins. Before starting the operation, a shroud door with door lock must enclose the drum and the compressing cylinder rod and plate.

The assembly incorporates a fail-safe switch that does not permit the compaction operation when the compactor door is open. An operator initiates the compaction process by positioning an up/down switch in the down position, which energizes the hydraulic pump motor. The hydraulic pressure forces the ram down into the drum, thereby compressing the wastes. The shroud door is opened, the drum is removed, and additional wastes are added to the drum. The cycle is repeated until the drum is full. The lid is then installed, the clamping ring tightened, and the drum is stored pending shipment.

Partially contaminated air during compactor operation is evacuated by an integral blower, which directs airflow through a HEPA filter with air efficiency of greater than 99 percent. The filter outlet is connected to the auxiliary building ventilation exhaust system.

The compactor 'hydraulic press and exhaust fan' is operated from an integrally mounted electric control panel.

9

TABLE 11.4-5
(Sheet 1 of 10)

SOLID WASTE MANAGEMENT SYSTEM

	Component Parameters			
Component	Code Design	Safety Class	Parameter	2
TANKS				
1. Spent resin storage tank	ASME VIII	NNS		9
Number			1	
Usable volume, ft³			350	
Type			Vert.	
Design pressure, psig			100	
Design temperature, F			200	2
Material			SS*	
Diaphragm			No	

*All stainless steel in this table is either type 304 or 316.

TABLE 11.4-5
(Sheet 2 of 10)

SOLID WASTE MANAGEMENT SYSTEM 2

Component	Code Design	Safety Class	Parameter	
			Component Parameters	
2. Evaporator concentrates storage tank	ASME VIII	NNS		9
Number			2	
Usable volume, gal			2000 (each)	
Type			Vert.	2
Design pressure, psig			150	
Design temperature, F			250	
Material			SS	
Diaphragm			No	

TABLE 11.4-5
(Sheet 3 of 10)

SOLID WASTE MANAGEMENT SYSTEM

Component	Code Design	Safety Class	Parameter	
		Component Parameters		
Component	Code Design	Safety Class	Parameter	2
3. Chemical drain tank	API 620	NNS		
Number			1	
Usable volume, gal			600	
Type			Vert.	
Design pressure			Atmos.	
Design temperature, F			200	
Material			SS	
Diaphragm			No	

9

TABLE 11.4-5
(Sheet 4 of 10)

SOLID WASTE MANAGEMENT SYSTEM 2

DELETED 9

TABLE 11.4-5
(Sheet 7 of 10)

SOLID WASTE MANAGEMENT SYSTEM

Component	Code Design	Safety Class	Parameter	
	Component Parameters			
3. Evaporator concentrates tank pump	Mfg Std	NNS		
Number			1	
Type			Canned	2
Design pressure, psig			150	
Design temperature, F			250	
Design flow, gpm				
Recirculation Mode			100	
Process Mode			35	
Design head, ft				
Recirculation Mode			250	
Process Mode			200	
Material			SS	

TABLE 11.4-5
(Sheet 8 of 10)

SOLID WASTE MANAGEMENT SYSTEM 2

DELETED

9

TABLE 11.4-5
(Sheet 9 of 10)

SOLID WASTE MANAGEMENT SYSTEM 2

	Component Parameters		
Component	Code Design	Safety Class	Parameter
4. Waste solidification package			
Utility Applicant's SAR			

9

TABLE 11.4-5
(Sheet 10 of 10)

SOLID WASTE MANAGEMENT SYSTEM

Component Parameters

Component	Code Design	Safety Class	Parameter	
FILTERS				
Spent resin sluice filter	ASME VIII	NNS		
Number			1	2
Design pressure, psig			150	
Design temperature, F			200	
Design flow, gpm			150	
P at design flow, psi			5	
Size of particles, 98 percent ret., microns (nominal)			25	
Surface radiation level, R/hr			100	
Materials				
Housing			SS	
Filter Element			Epoxy impreg-nated cellulose fiber	

j. Give an alarm on high radiation level by using a high-high set point alarm

k. Control the release of radioactive liquids, gases, and particulates produced in the operation of the plant by initiating prompt corrective action through automatic isolation systems, or via operator response

Continuous monitoring means that the monitor operates essentially uninterrupted for extended periods. However, this does not mean that the monitors are maintenance free. Preventive maintenance is normally coordinated with plant shutdowns, and necessary maintenance or repair and calibration outages are minimized by equipment design. Consideration is given to providing needed augmentation if conditions warrant.

The accomplishment of these general objectives by the continuously operating PERMS assists in maintaining for individuals in restricted and unrestricted areas, during both normal and accident conditions, exposure levels as low as reasonably achievable (ALARA)

11.5.2 System Description

The RMS will be a current state-of-the-art system that has the PERMS and ARMS system integrated. The system will be dual dedicated microcomputers in communication with each other and a distributed dedicated micropre cessor for each system monitor. 9

11.5.2.1 Design Criteria

The following criteria are used in the design of the RMS: 9

a. The system is of a digital rather than analog type. The digital system uses, adjacent to each detector element, microprocessors which preprocess the data ard provide the capability of independent local readout when required. The high-voltage supply is also located at this point. Such a system allows computer handling of the data, and incorporates the most recent in solid-state processing equipment.

b. The digital system is subdivided into two groupings:

1) Monitors that serve as Reactor Coolant Pressure Boundary (RCPB) leak rate indicators; this group must be seismically qualified 2
2) Those not seismically qualified.

The seismically qualified channels are isolated from each other electrically with independent wiring to the central independent physically separated consoles, so that each detector is unaffected by the operation of any other unit. Optical isolation at each detector provides channel independence. 9

c. All monitors register full scale if exposed to radiation levels up to 100 times full-scale indication without foldover.

d. The PERMS readout and controls are located in the control room so that they will be convenient to the operator, enabling proper overview of plant conditions. Additional local indication and alarms, where necessary, are provided to alert operating personnel, e.g., waste processing system control panel.

e. Each monitor automatically provides the control room with a readout, a high alarm, a high-high alarm, and a failure/loss-of-background alarm as a minimum.

Each monitor's high alarm is set at a level determined by operating personnel to allow attention to be drawn to positive increases in activity.

The high-high alarm is chosen to ensure that the instantaneous release rates are within plant technical specifications. These values are dependent upon the maximum anticipated flow rates. | 2

The failure/loss-of-background alarm actuates if the monitor loses its power source, or if there isn't a normal background level as a result of signal circuit failure or other similar failures.

f. Alarm setpoints are under the administrative control of the plant manager, or his authorized delegate.

g. The proper operation of each detector is checked as required with a check source that is built into each detector but controlled from the control room. These check sources show a reading of approximately 30 percent of full scale.

h. Backup monitors are provided by placing monitors in series in appropriate discharge paths, as described in this section and located as indicated by Table 11.5-1.

i. Diversity of monitor types and principles are used to the extent feasible to enhance system reliability.

j. The monitors are placed where they are readily accessible and where the background is determined to be the lowest for the area.

k. Adequate lead shielding is provided so that background radiation has reasonably minimal effect on detector capability to sense low activity levels. The minimum detectable concentration is deemed to be that count rate associated with the background

count rate plus two-times the background standard deviation. Background is considered to be the larger of either 1 MR/hour of 1 meV gamma radiation, or the design maximum for the area, as given in Section 12.3.

l. Spare equipment is provided for those components requiring maintenance and natural replacement.

m. Equipment is placed indoors for protection from the effects of extreme winds, floods, tornadoes, or missiles, as described in Chapter 3.

n. Environmental design conditions for the components, excluding detectors, are as follows:

1) Ambient temperature range of -10 C to 50 C

2) Relative humidity of 30 percent to 100 percent (100 percent without visible water droplets)

3) Normal atmospheric pressure $\pm$5 psig

q. Each analog channel has a minimum range of 5 decades. | 9

11.5.2.2 Locations to be Monitored

All normal and potential paths for release of radioactive material during normal reactor operation, including anticipated operational occurrences and accidents are being monitored as indicated by NRC Regulatory Guide 1.21. Based on this, monitors are provided for:

a. Process lines which may discharge radioactive fluids to the environs, in order to indicate and alarm when preestablished limits are reached or exceeded

b. Process lines which do not discharge directly to the environs, in order to indicate possible process system malfunctions, deteriorating performance, or failure by detecting increases in radioactivity levels

Section 11.5.2.5 lists the local locations of detectors: | 2
Table 11.5-1 summarizes the detector information.

11.5.2.3 Anticipated Concentrations, Sensitivities, and Ranges

The monitors use scintillation crystals (predominantly) or Geiger-Muller (G-M) tubes to detect either beta or gamma

radiation, or both over an energy range of at least 0.08 to 2.5 meV.

ANSI-N13.1, 1969 provides guidance on detector locations, sample line routes, and sampling of air streams.

The sensitivity and range of each detector, along with other pertinent factors such as preferred detector type, reference nuclide, and anticipated medium concentration are given in Table 11.5-1.

11.5.2.4 Description of Liquid Process and Effluent Monitors, General

Each channel of the system contains a completely integrated modular assembly.

When appropriate, in-line monitors are used. This provides complete monitoring of the liquid as there is no possibility of improper sampling. Consequently, pumps, which require maintenance, are not required, and auxiliary flow devices are unnecessary.

Off-line monitors, when required because of temperature or other considerations allow for ease of chamber decontamination. If pressure differential cannot be used to assure proper off-line flow, a quality pump is provided. A flow device is provided in either case.

On-line (saddle or snowplow) type detectors may also be implemented. These have the same advantages as in-line monitors and, unlike off-line monitors since the existing piping is not altered, provide no additional flow blockages or sediment collection points. Their use is regulated by necessary sensitivity considerations.

Each in-line and off-line chamber as well as auxiliary piping is made of stainless steel of the necessary quality to conform to ASTM standards. In addition, all monitors, regardless of type, are capable of being decontaminated by rinsing in place.

11.5.2.5 Description of Liquid Process and Effluent Monitors, Specific

The following paragraphs contain a brief description of each of the liquid process and effluent monitors.

a. Auxiliary Steam Condensate Monitor

12.3.3.2 System Design Criteria

The atmosphere cleanup units remove contaminants from the exhaust air of the primary plant ventilation system (which includes the controlled-access exhaust, containment-purge exhaust, and fuel-handling building exhaust ventilation systems), and from the hydrogen-purge exhaust system.

These systems are described in Sections 9.4, 6.2, and 6.5. In addition to the use of the atmosphere cleanup units described previously, the emergency filtration units and emergency pressurization units of the control room HVAC system remove contaminants from the control room environment and prevent contaminants from entering the control room atmosphere during emergency modes of operation. The control room HVAC system is discussed in Sections 9.4.1 and 6.4.2

12.3.3.3 Component Design Criteria

The components comprising the non-ESF atmosphere cleanup units are prefilter, HEPA filters (two), iodine adsorbers, fans, isolation valves, and related instrumentation. Atmosphere cleanup units are comprised of the above components, with the addition of demister and heaters to maintain the relative humidity below 70 percent.

12.3.3.4 Testing, Isolation, and Decontamination

Each atmosphere cleanup unit housing has permanent test connections for DOP (dioctyl phthalate) leak testing of the HEPA filters and refrigerant leak testing of the adsorber section. Leak testing is performed semiannually on all units. In addition, a deluge system is provided to extinguish an adsorber section fire if a charcoal adsorber is used. The operation of the deluge system is discussed in Section 9.5. Inspection and testing requirements for ESF and non-ESF filter housings are discussed in subsection 9.4.1.4. The arrangement of these units allows access to the unit and equipment by personnel for maintenance and testing. All housings have multiple drains which are connected to the equipment and floor drainage system. Decontamination water stations are in proximity to each unit to facilitate decontamination. Figures 6.5-1 and 9.4-17 illustrate typical layouts for ESF and non-ESF atmospheric cleanup units, respectively.

12.3.3.5 Maintenance

All housings are designed to provide ample room for maintenance of equipment and filters and to minimize the radiation exposure 1 to personnel during filter replacement. The criteria for replacement of filters are established on the basis of maximum allowable resistance of the dirty filter or minimum radiation exposure to personnel, or both. Each filter train is provided with a pressure indicator. High pressure actuates an alarm in the control room. Each filter of the filter train is provided with a local pressure indicator. Upon reaching the maximum resistance, the filters are replaced. The maximum allowable resistance for each type of filter is indicated in Table 9.4-4.

The criteria for replacement of the adsorber section is based on the deterioration of adsorber ability to remove radioactive iodine from the exhaust air. This efficiency is determined by laboratory testing of representative samples of the activated charcoal exposed simultaneously to the same service conditions as the adsorber section. Each sample has the same qualification and batch test characteristics as the system adsorber. Samples are tested periodically (approximately semiannually) in accordance with Regulatory Position C6.b of Regulatory Guide 1.52. The adsorber section is replaced after the last sample has been removed and tested, or if one of the samples fails to meet the requirements of NRC Regulatory Guide 1.52, Table 2.

12.3.3.6 Conformance to Regulatory Guide 1.52

The ESF and non-ESF atmosphere cleanup units conform to the regulatory positions and recommendations of Regulatory Guide 1.52 as shown in Table 6.5-1.

12.3.4 Area Radiation and Airborne Radioactivity Monitoring Instrumentation

The ARM system is part of an integrated system of the RMS including the airborne radioactivity monitoring instrumentation 9 of the PERMS. This RM system is described in Section 11.5

12.3.4.1 Area Radiation Monitoring System

Fixed, gamma-sensitive monitors are located throughout the plant for the protection of personnel. The following criteria govern monitor locations and design and performance requirements:

a. Location Criteria

Detectors are located in spaces that may be occupied and where there is potential for dose rates in excess of the radiation zone

Question 111.55 (3.6.2.1)

Section 3.6.2.1.2 (page 3.6-6) of the SSAR adopts Branch Technical Position MEB 3-1 as the basis for determining postulated pipe break locations in high energy piping systems outside containment. An element of this BTP (position B.1.b) is the establishment of criteria for piping in the containment penetration area where pipe breaks need not be postulated. Unfortunately, all the criteria are not contained in the BTP. Therefore, commitment to the BTP is not sufficient, in and of itself, if pipe breaks are not to be postulated in the containment penetration area. 9

Therefore, it will be necessary to expand section 3.6.2.1.2 of the SSAR to indicate that either:

(1) Pipe breaks will be postulated in the containment penetration area using the criteria of positions B.1.c and B.1.d; or

(2) In addition to meeting the criteria of position B.1.b, all piping in the containment penetration area will have a 100 percent volumetric examination of all circumferential and longitudinal welds during each inspection interval (IWA-2400 of Section XI of the ASME Code.)

Response Q111.55 (3.6.2.1)

See revised Section 3.6.2.1.2.a.

Question 111.56 (3.6.1.1)

The third paragraph of Section 3.6.1.1.a. (page 3.6.2) of the SSAR references portions of Section 3.6.2.1.2 which have been deleted. Revise this paragraph to reference BTP MEB 3-1 directly. 9

Response 111.56 (3.6.1.1)

See revised Section 3.6.1.1.a.

Question 122.7

Confirm that when ASTM material specifications are used for safety related components, the quality, control provisions of the ASME Code, Section III NA-3700 will apply.

Response 122.7 9

ASME Section III, Subsection NCA-3800 (summer 1977) supersedes Subsection NA-3700 (1977). The quality control provisions of ASME Section III, Subsection NCA-3800 will apply to all ASTM material specifications used for safety related pressure retaining components.

Question 122.8

Confirm that the new fracture toughness provisions of the Code, NC/ND-2300 will apply to steam and feedwater system materials. List the steam and feedwater system materials as was done for ESF materials in GIBBSSAR Table 6.1.1. 9

Response 122.8

The fracture toughness provisions of the Code NC/ND-2300 (summer 1978 Addenda) will apply to all pressure retaining material and material welded thereto, in the main steam and feedwater system. A list of main steam and feedwater system materials are provided in GIBBSSAR Table 10.3-2.

Question 122.9

While GIBBSSAR (5.2.3.3) addresses Regulatory Guides 1.50, 1.43, 1.34, 1.71 and 1.66 with regard to ferritic and low alloy steels of the reactor coolant pressure boundary within the scope of the 9 BOP, we are unable to determine from the reactor coolant system descriptions where these materials will be applied.

Response 122.9

A review of the reactor coolant system descriptions indicates there are no ferritic and low alloy steels of the reactor coolant pressure boundary which are within the scope of the BOP.

Question 122.10

Confirm that all stainless steel components subject to the provision of Regulatory Guide 1.44, Position C.3, will be in the solution annealed and water quenched condition.

Response 122.10

G&H's position concerning stainless steel components subject to the provision of Regulatory Guide 1.44, Position C.3, requires that annealed and quenched materials be used and that the material is not unduly sensitized during manufacture and installation, and that the material is protected against contaminants which would aid in causing cracks. Position C.3 of the Regulatory Guide 1.44 requires testing to verify the nonsensitization of austenitic stainless steel forms other than "plate sheets, bass, pipes and tubes". G&H also excludes from sensitization testing, those forgings, fittings and other shaped products, which do not have inaccessible cavities or chambers which would preclude rapid cooling when water quenched, as denoted in GIBBSSAR Section 5.2.3.4. 9

Question 122.11

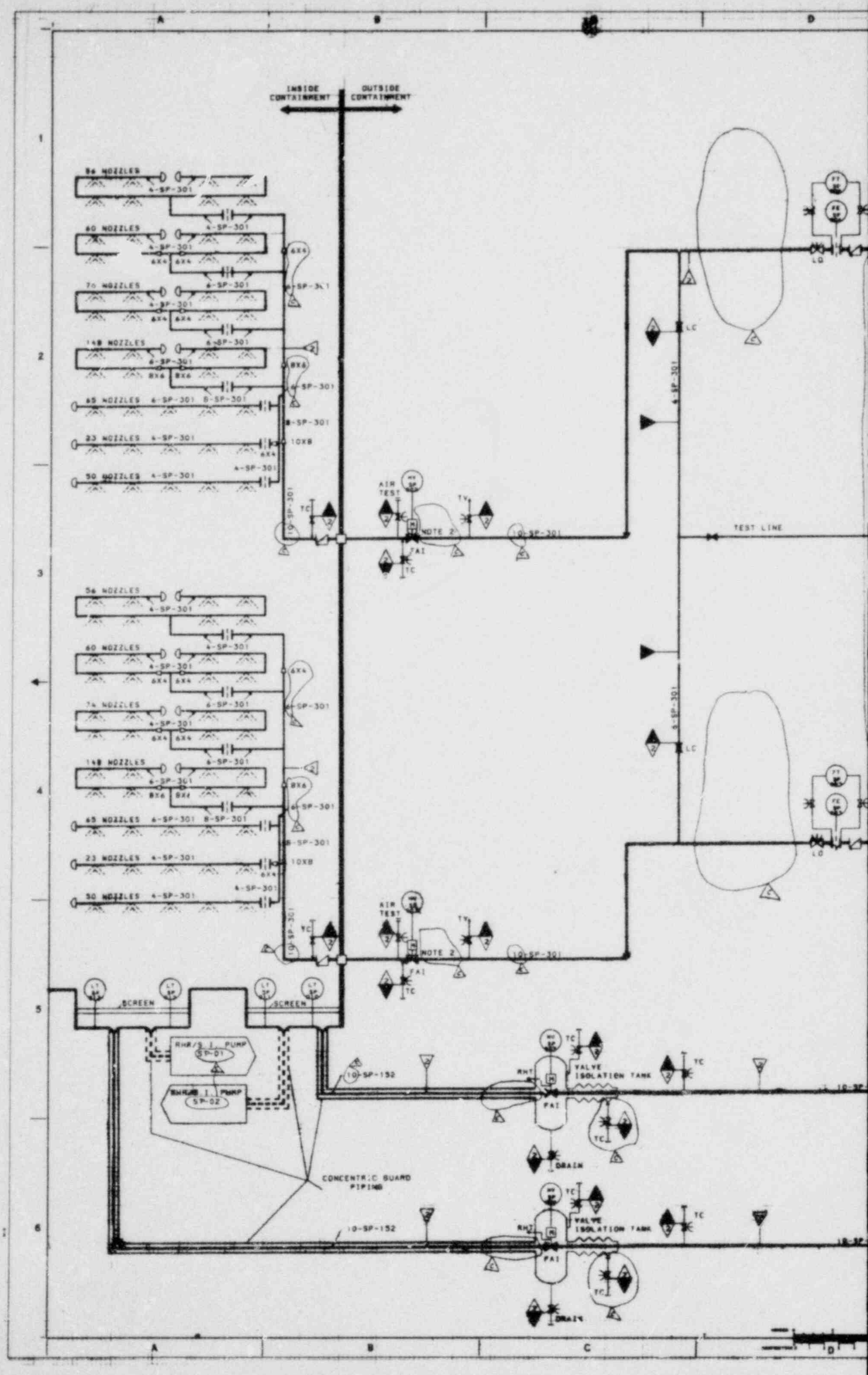
ASME Code Section III, Subsection NE 2331 requires that fracture toughness requirements be met at 30 F below the "lowest metal service temperature." What is the "lowest metal service temperature" for the GIBBSSAR containment materials subject to this requirements?

Response 122.11

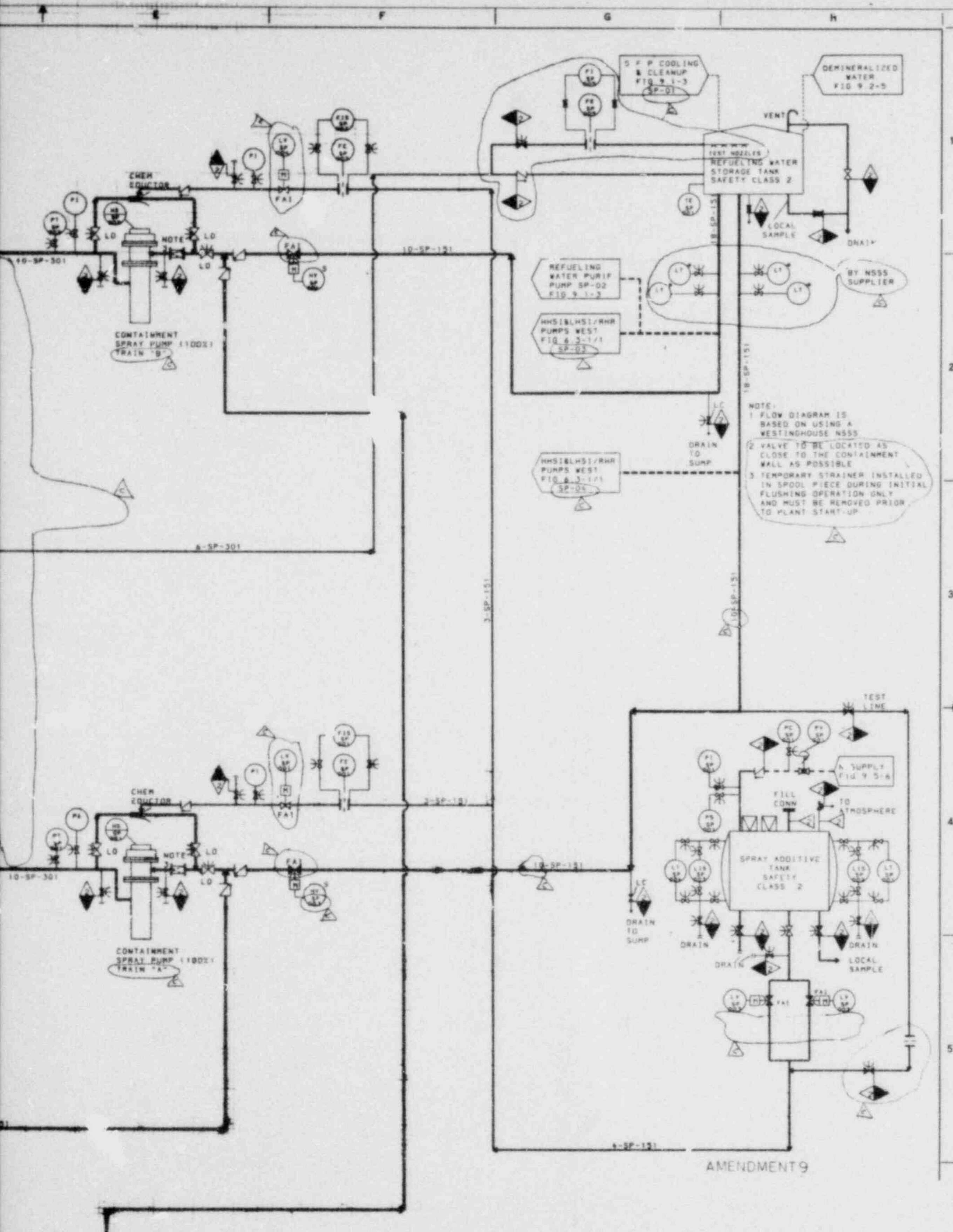
The "lowest metal service temperature" for the GIBBSSAR containment materials subject to the fracture toughness requirements of ASME Code Section III, Subsection NE 2331 will not be lower than 60 F. The assumption upon which the calculation of this temperature is based are as follows: 9

- The plant is at the end of a refueling outage
- The reactor coolant pumps are not in operation
- The containment purge system is in operation
- The outdoor ambient temperature is sustained at -40 F
- The outdoor wind velocity is 15 mph

Also refer to subsection 9.4.6.1.e for a discussion of the operation of the containment purge system.



INSIDE CONTAINMENT
OUTSIDE CONTAINMENT
60 NOZZLES
74 NOZZLES
148 NOZZLES
65 NOZZLES
23 NOZZLES
50 NOZZLES
56 NOZZLES
4-SP-301
6-SP-301
8-SP-301
10-SP-301
10X8
AIR TEST
NOTE 2
FAI
TEST LINE
SCREEN
RHR/S 1 PUMP
SP-01
SP-02
10-SP-152
VALVE ISOLATION TANK
DRAIN
CONCENTRIC GUARD PIPING
LC
LO
TC
TY



GIBBSSAR

NSSS:
NOT SPECIFIC ☐
W-414 ■
CE ☐
B&W ☐

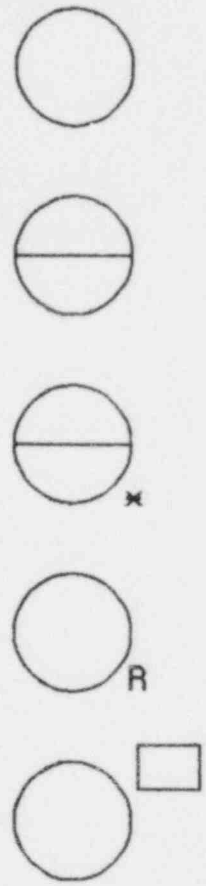
FLOW DIAGRAM
CONTAINMENT SPRAY SYSTEM

FIGURE NO. 6.2-25

MEANING OF IDENTIFICATION L		
	FIRST LETTER	SUC
	MEASURED OR INITIATED VARIABLE	READOU
A	ANALYSIS	ALARM
B		BISTABLE
C	CONDUCTIVITY	CONTROL
D	DENSITY OR SPECIFIC GRAVITY	DIGITAL COM
E	VOLTAGE OR EMF	PRIMARY EL
F	FLOW	
G	GAGING	GLASS
H	HAND	
I	CURRENT	INDICATOR
J	POWER	
K	TIME OR TIME SCHEDULE	CONTROL STA
L	LEVEL	LIGHT
M	MOISTURE OR HUMIDITY	
O		ORIFICE (RE
P	PRESSURE OR VACUUM	POINT
Q		POWER SUPPL
R	RADIOACTIVITY	RECORD OR P
S	SPEED OR FREQUENCY	SWITCH
T	TEMPERATURE	TRANSMITTER
U	MULTIVARIABLE	MULTIFUNCTI
V	VISCOSITY	VALVE DAMPE
W	MONITOR	WELL
X	TRIP	UNCLASSIFIE
Y	STATUS	SIGNAL MODI
Z	POSITION	

ETTERS
CCEEDING LETTER
IT OR PASSIVE FUNCTION
PUTER OR DIFFERENTIAL
MENT
TION
STRICTION)
Y OR QUANTITY
RINT
ON
R OR LOUVER
D
F. RELAY OR COMPUTE

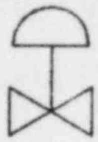
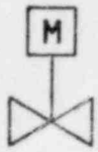
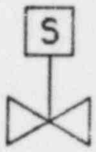
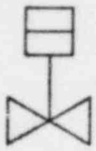
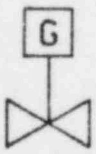
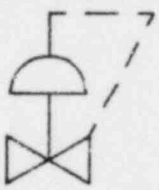
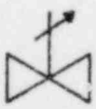
INSTRUMENTATION SYMBOLS



DET.	SYM.	DESCRIPTION
1		LOCALLY MOUNTED
2		MAIN BOARD MOUNTED
3		AUXILIARY BOARD MOUNTED * SPECIFIED BOARD DESIGNATION
4		RACK MOUNTED R--- SPECIFIC RACK DESIGNATION
5		AUXILIARY CONTROL FUNCTION DESIGNATION

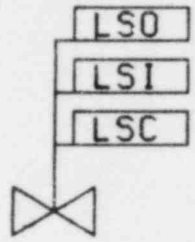
GIBBSSAR	INSTRUMENTATION AND CONTROL SYSTEM LOGIC DIAGRAM
NSSS: ☐ NOT SPECIFIC ☒ W-414 ☐ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.A

VALVE OPERATOR TYPES

DET.	SYM.	DESCRIPTION
1		AIR DIAPHRAGM
2		ELECTRIC MOTOR
3		SOLENOID
4		PISTON
5		MANUAL GEAR OPERATED
6		SELF-CONTAINED PRESSURE REGULATOR
7		THROTTLING SERVICE

VALVE ACCESSO
DEFINITIONS & ABBR

SYM.



FC-----FAIL C
FO-----FAIL O
FAI----FAIL A
NO-----NORMAL
NC-----NORMAL

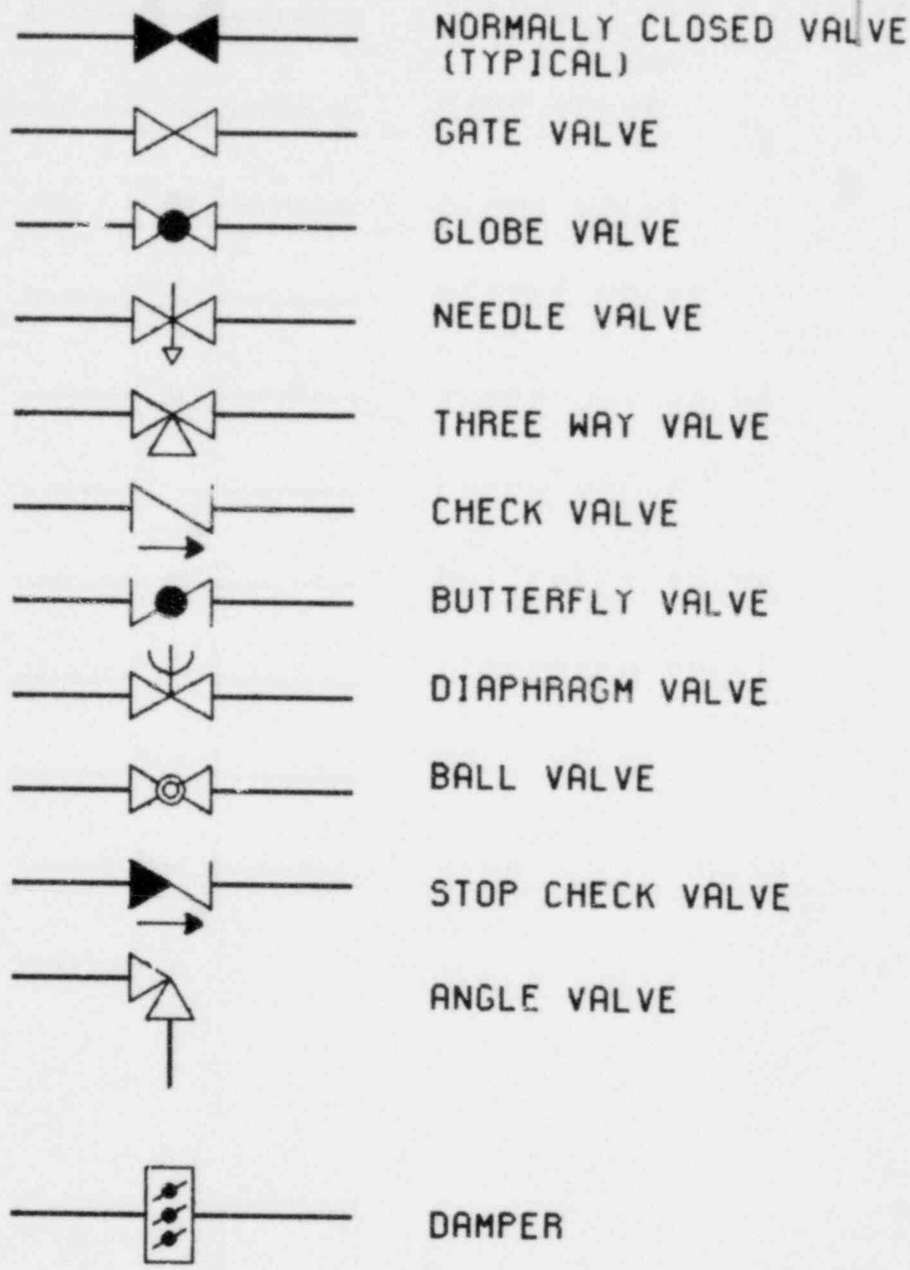
RIES
EVIATIONS

DESCRIPTION

LIMIT SWITCHES
LSO-OPEN
LSC-CLOSED
LSI-INTERMEDIATE

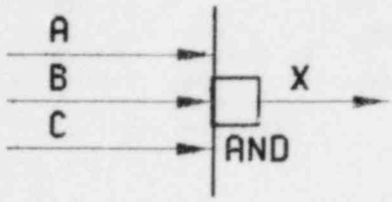
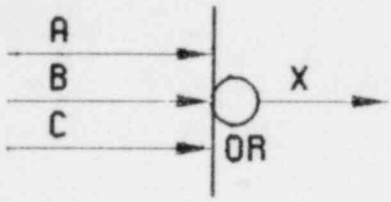
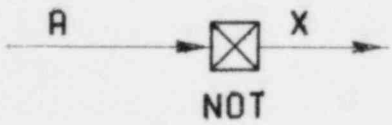
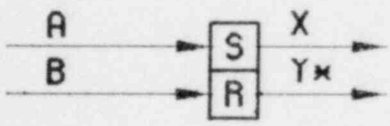
LOSE
PEN
S IS
LY OPEN
LY CLOSED

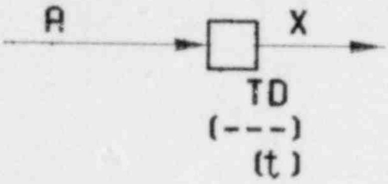
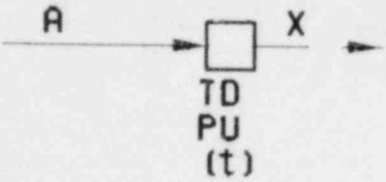
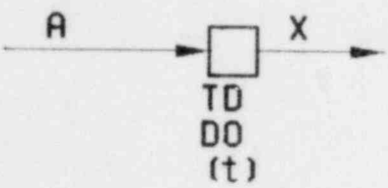
VALVE BODY TYPES



GIBBSSAR	INSTRUMENTATION AND CONTROL SYSTEM LOGIC DIAGRAM
NSSS: ☐ NOT SPECIFIC ☒ W-414 ☐ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.B

LOGIC SYMBOLS

DET.	SYM.	DESCRIPTION
1		LOGIC OUTPUT X EXISTS IF AND ONLY IF ALL LOGIC INPUTS A.B.C. EXIST.
2		LOGIC OUTPUT X EXISTS IF AND ONLY IF ONE OR MORE LOGIC INPUTS A.B.C. EXIST.
3		LOGIC OUTPUT X EXISTS IF AND ONLY IF LOGIC INPUT A DOES NOT EXIST.
4	 MAINTAINED MEMORY	S REPRESENTS "SET MEMORY" R REPRESENTS "RESET MEMORY" LOGIC OUTPUT X EXISTS AS SO AS LOGIC INPUT A EXISTS. X CONTINUES TO EXIST REGARD SUBSEQUENT STATE OF A UNTIL MEMORY IS RESET (TERMINATED LOGIC INPUT B EXISTING LOGIC OUTPUT Y IF USED EXIS X DOES NOT EXIST AND Y DOES WHEN X EXISTS. NOTE: * OUTPUT Y IS NOT SHOWN IF IT IS NOT USED.

DET.	SYM.		DESCRIPTION
5		ADJUSTABLE TIME DELAY	(---) SHALL BE CODE LETTERS AS DEFINED BELOW FOR MODE OF TIMER OPERATION. (t) IS THE NORMAL DELAY TIME WITH APPROPRIATE UNITS (SEC.,MIN.,HR.).
6		ADJUSTABLE TIME DELAY PICK-UP	PU - PICK-UP THE CONTINUOUS EXISTANCE OF LOGIC INPUT A FOR A TIME (t) CAUSES X TO EXIST WHEN (t) EXPIRES. X TERMINATES WHEN A TERMINATES.
7		ADJUSTABLE TIME DELAY DROP-OUT	DO - DROP-OUT THE INITIATION OF A CAUSES X TO EXIST IMMEDIATELY. X TERMINATES WHEN (t) EXPIRES AFTER A TERMINATES.

ON

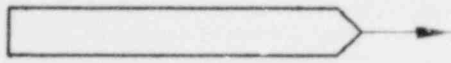
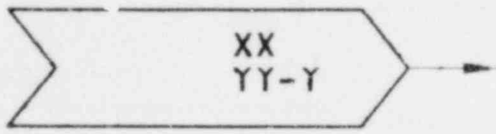
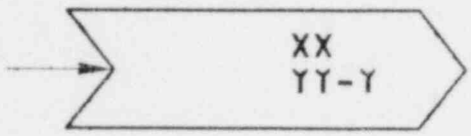
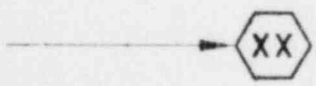
LESS OF THE
THE
) BY

TS WHEN
NOT EXIST

NOTE:
OTHER MODES OF TIMER OPERATION SHALL BE HANDLED BY APPROPRIATE EXPLANATORY NOTES.

GIBBSSAR	INSTRUMENTATION AND CONTROL SYSTEM LOGIC DIAGRAM
NSSS: NOT SPECIFIC ☒ W-414 ☐ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.C

LOGIC & LOOP DIAGRAM SYM

DET.	SYM.	DESCRIPTION
1		CONTROL SWITCH
2		LOGIC INPUT FROM EXTERN XX: REFERENCE DESCRI OF THE COMPONENT YY-Y: THE DRAWING NUMB THE SIGNAL IS CO
3		LOGIC OUTPUT USED AS IN EXTERNAL LOGIC. XX: REFERENCE DESCRI OF THE COMPONENT YY-Y: SYSTEM DRAWING N SHEET NUMBER WHE THE SIGNAL IS GO
4		LOGIC INPUT FROM INTERN (FROM PROCESS DWG. TO LO X-REFERENCE NUMBER NOTE: IF A LETTER APPEARS AFT THEN THERE IS ANOTHER R FROM THE SAME LOOP.
5		LOGIC OUTPUT TO INTERNA

BOLS

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ER FROM WHERE
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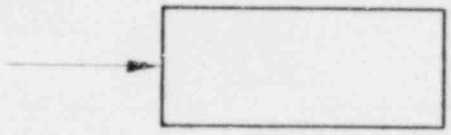
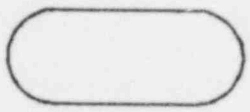
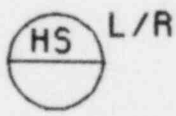
AL REFERENCE
GIC DWG.)

ER A NUMBER
EFERENCE

. REFERENCE

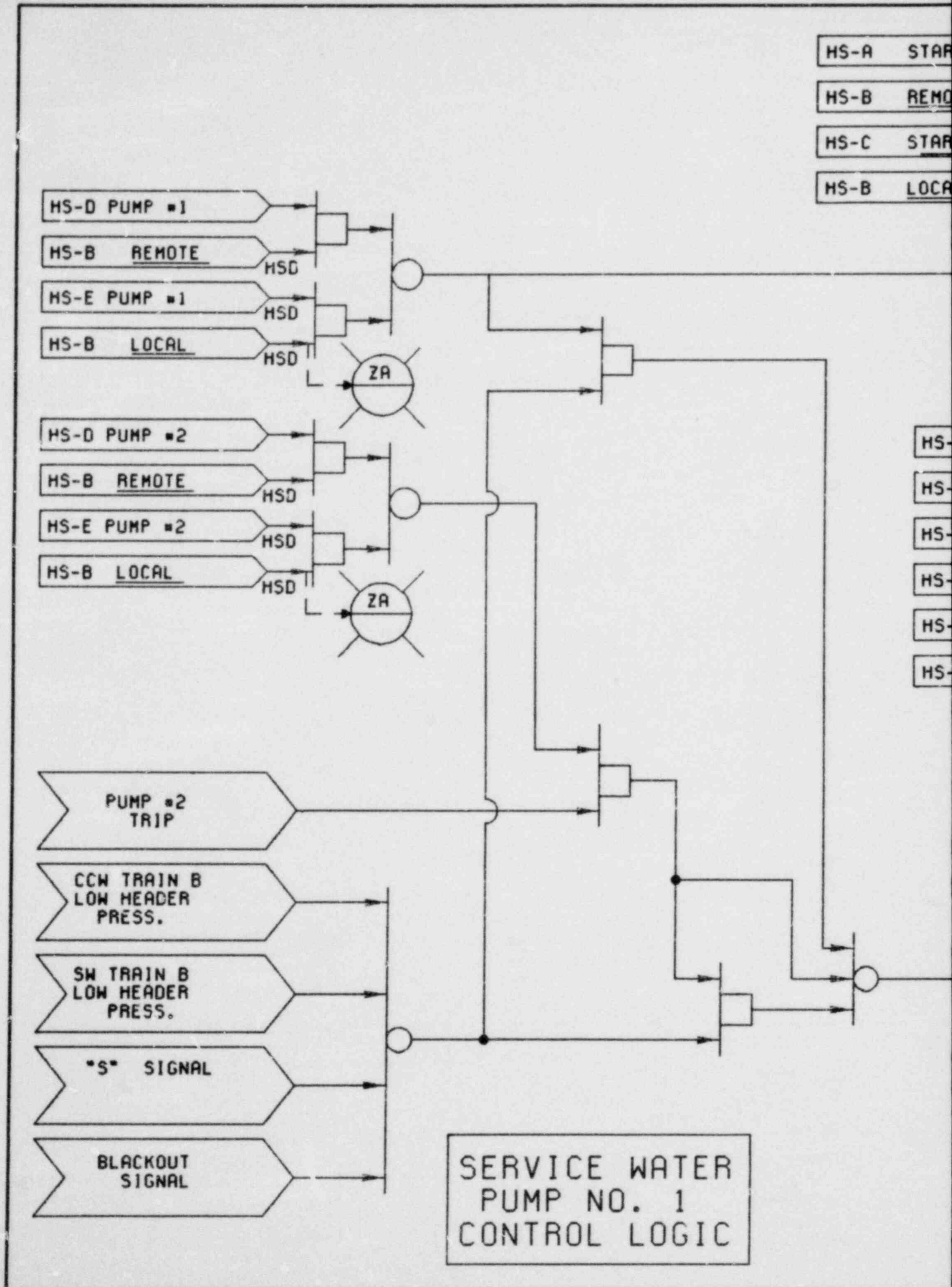
DET.	SYM.	DESCRIPTION
6		LOGIC OUTPUT
7		ACTION RESULTING FROM A LOGIC OUTPUT.
8	START — AUTO — STOP	CONTROL SWITCH, 3 POSITION, SPRING RETURN TO AUTO MAINTAINED POSITION OF ALL CONTROL SWITCHES INDICATED BY LINE UNDER THE POSITION IN WHICH SWITCH IS MAINTAINED.
9	HSD	DEVICE LOCATED AT HOT SHUT DOWN PANEL.
10		TRANSFER OF CONTROL SWITCH LOCATED AT HOT SHUT DOWN PANEL.
11	"S" SIGNAL PHASE A ISOLATION SIGNAL PHASE B ISOLATION SIGNAL F.W. ISOLATION SIGNAL M.S. ISOLATION SIGNAL	REFER TO RESAR-414 FIG.7.2-1

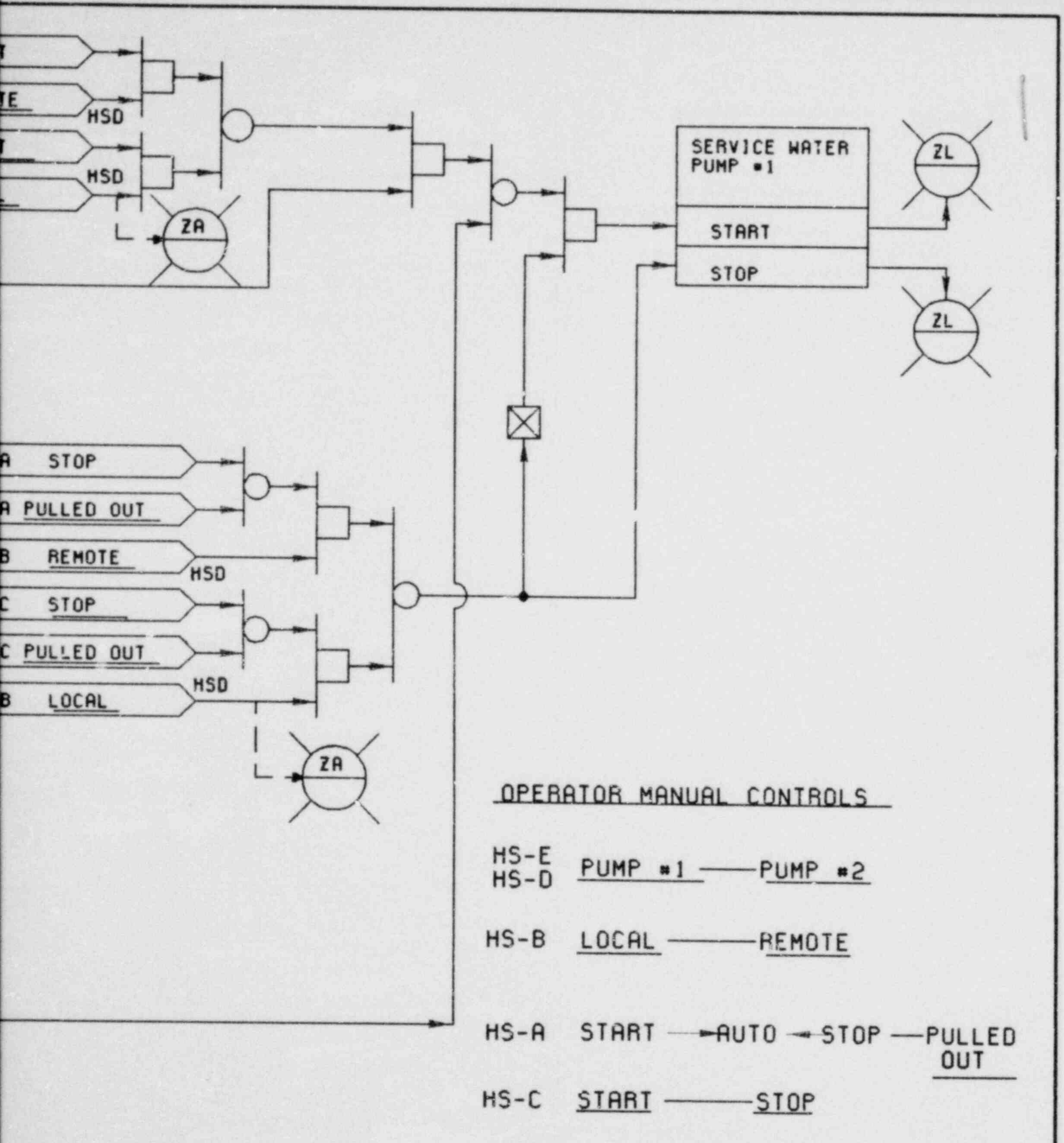
GIBBSSAR

NSSS:
NOT SPECIFIC ☒
W-414 ☐
CE ☐
B & W ☐

INSTRUMENTATION AND CONTROL SYSTEM LOGIC DIAGRAM

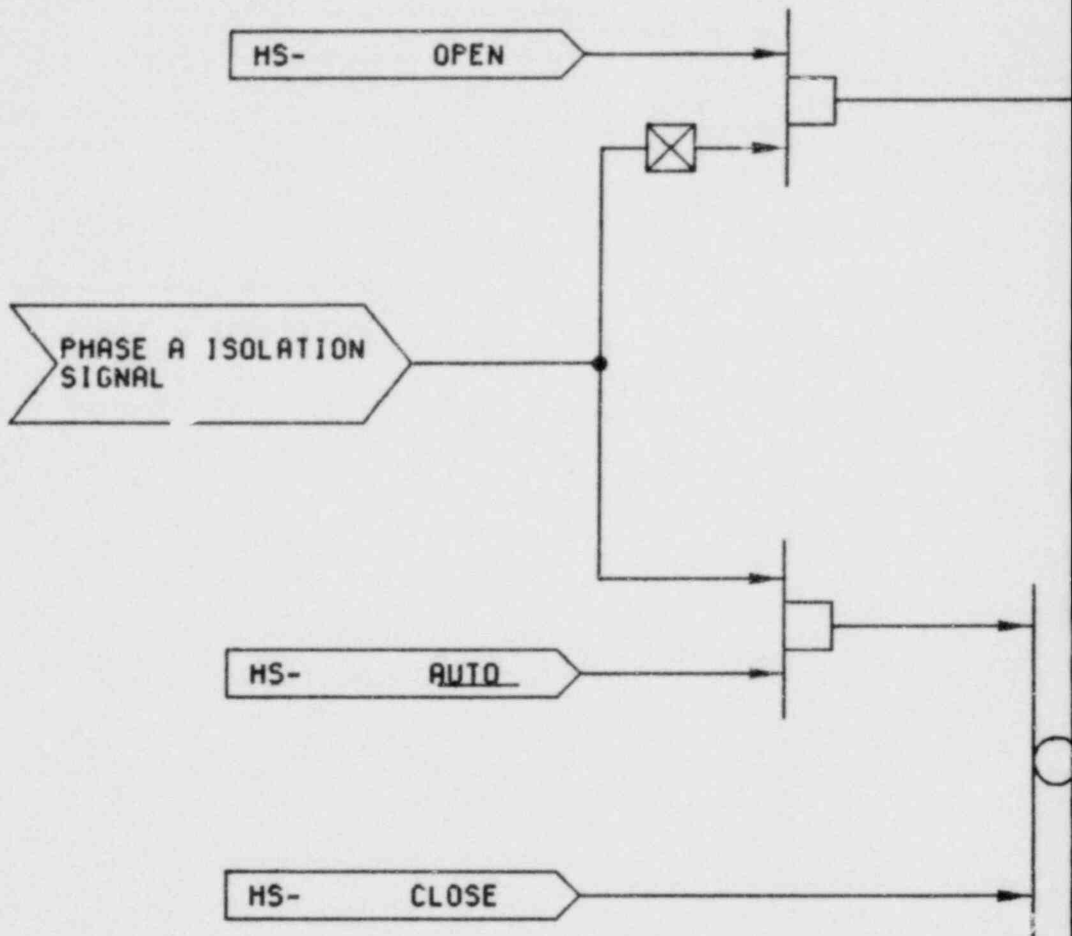
FIGURE NO. 7.3-1 SH.D


HS-A
HS-B
HS-C
HS-B
HS-D PUMP #1
HS-B REMOTE
HSD
HS-E PUMP #1
HSD
HS-B LOCAL
HSD
ZA
HS-D PUMP #2
HS-B REMOTE
HSD
HS-E PUMP #2
HSD
HS-B LOCAL
HSD
ZA
PUMP #2 TRIP
CCW TRAIN B LOW HEADER PRESS.
SW TRAIN B LOW HEADER PRESS.
"S" SIGNAL
BLACKOUT SIGNAL
SERVICE WATER PUMP NO. 1 CONTROL LOGIC



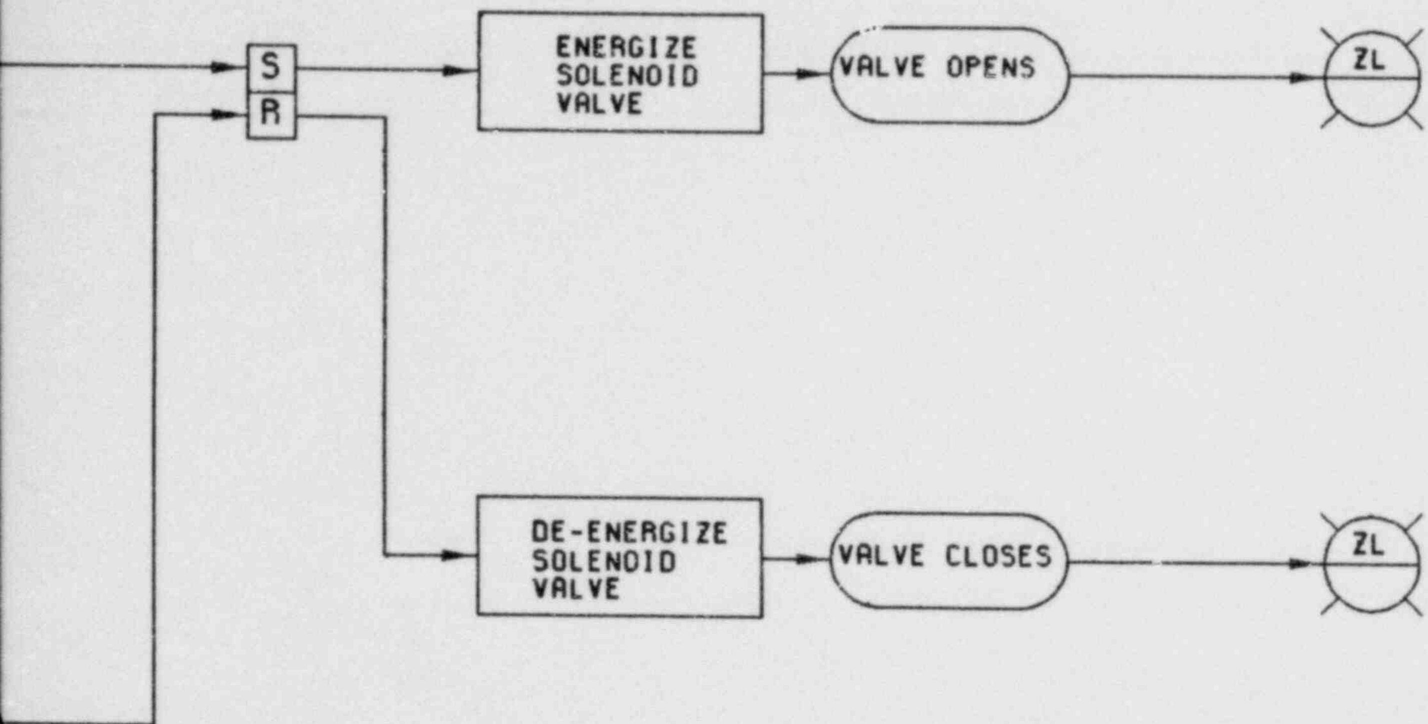
AMENDMENT 9

GIBBSSAR	INSTRUMENTATION AND CONTROL SYSTEM LOGIC DIAGRAM
NSSS: ☐ NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.1



NOTES:
1. CONTROL LOGIC SHOWN FOR HV-SW007. CONTROL LOGIC FOR HV-SW008 THRU HV-SW010 SIMILAR.

SERVICE WATER NON
ISOLATION VALVES

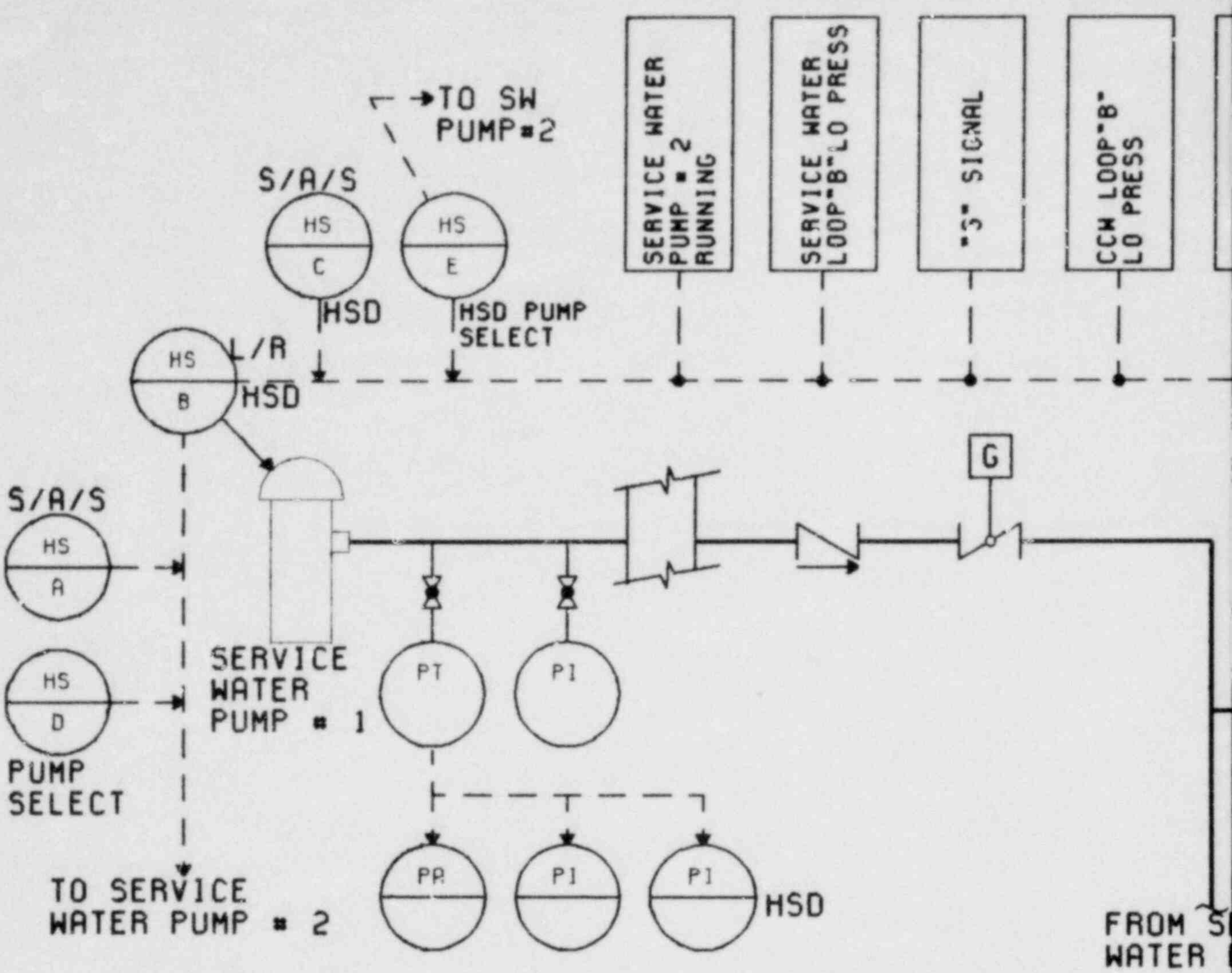


OPERATOR MANUAL CONTROLS

HS- CLOSE ► AUTO ◄ OPEN

AMENDMENT 9

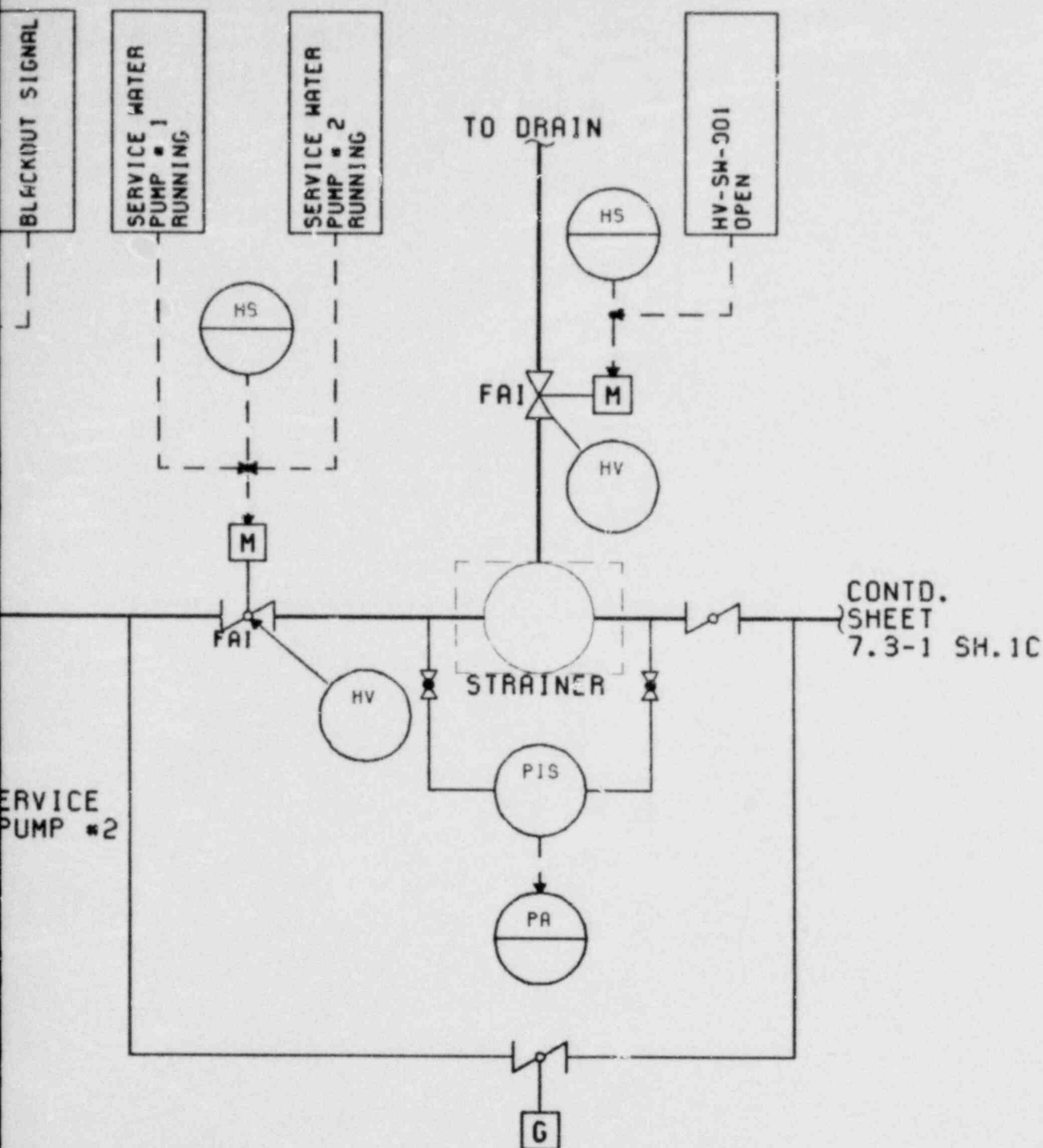
-ESSENTIAL LOOP CONTROL LOGIC	GIBBSSAR NSSS: NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	INSTRUMENTATION AND CONTROL SYSTEM LOGIC DIAGRAM FIGURE NO. 7.3-1 SH.1A



NOTE:

1. SIMILAR FOR LOOP B

SERVIC



AMENDMENT 9

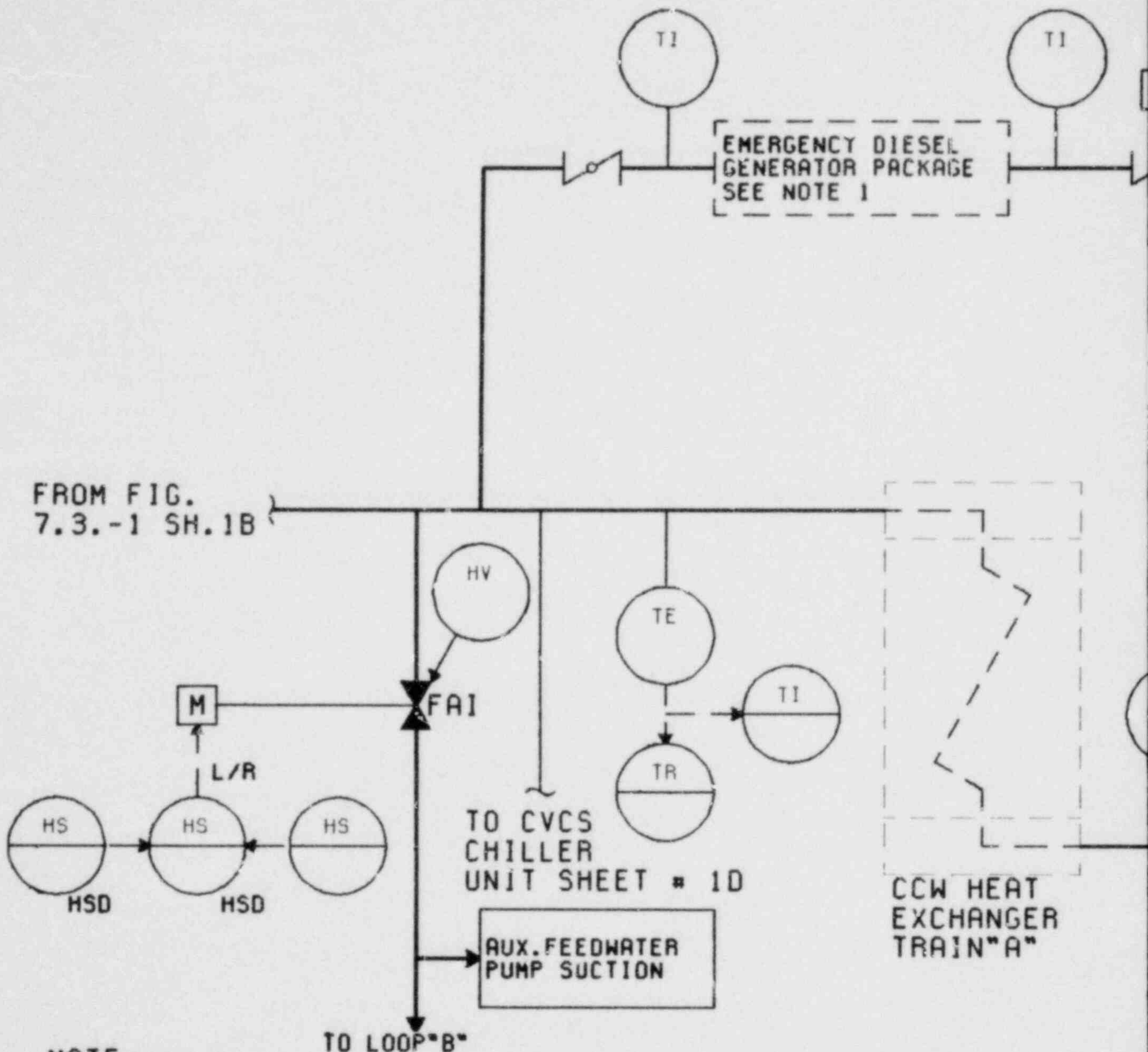
E WATER SYSTEM (LOOP A)

GIBBSSAR

NSSS:
NOT SPECIFIC ☐
W-414 ☒
CE ☐
B & W ☐

INSTRUMENTATION AND CONTROL SYSTEM DIAGRAM

FIGURE NO. 7.3-1 SH.1B.

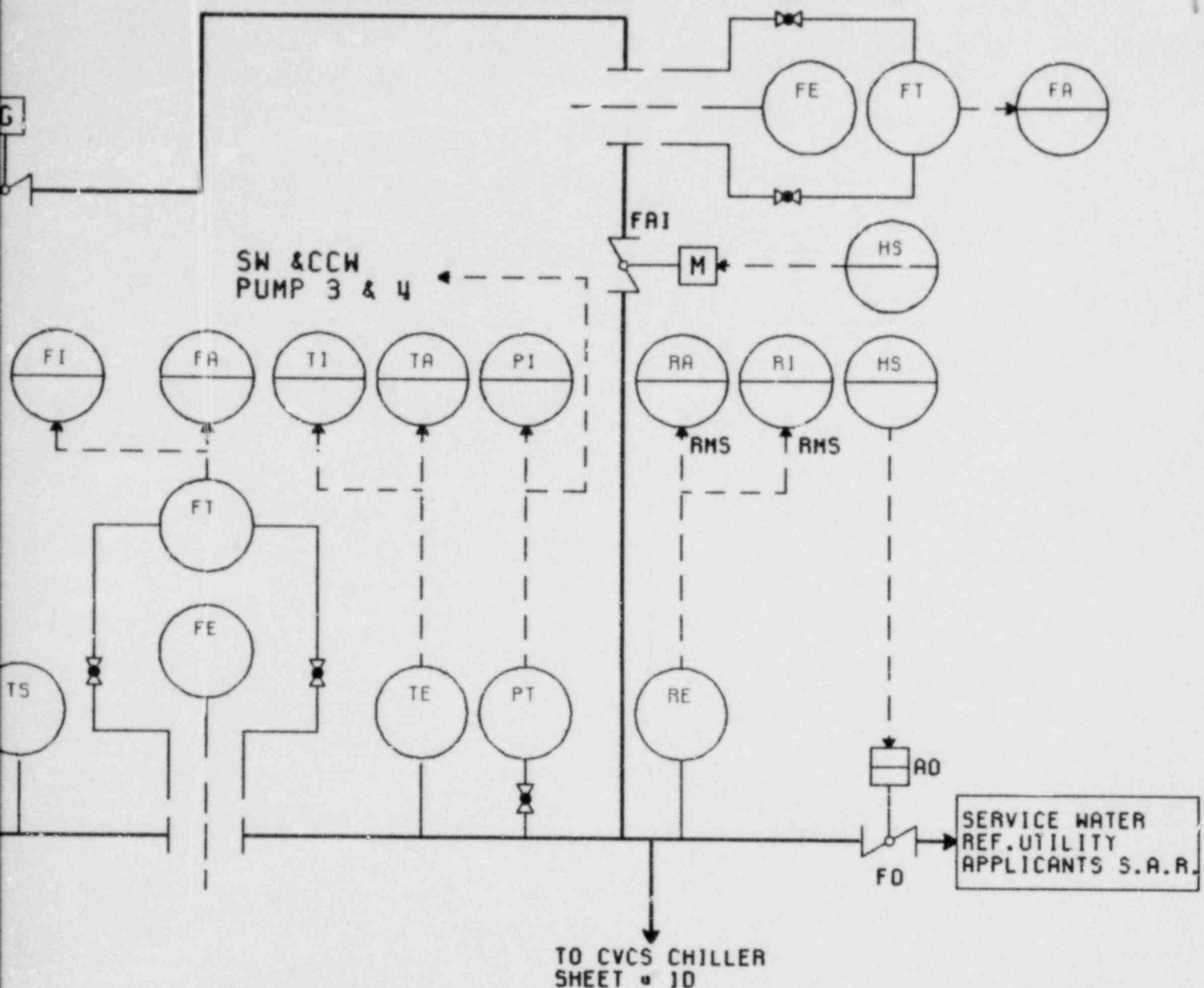


NOTE:

1. THE EMERGENCY DIESEL GENERATORS AND CVCS CHILLER UNIT WILL BE COOLED BY THE SERVICE WATER SYSTEM. ON THOSE SITES WHERE WATER QUALITY IS UNACCEPTABLE FOR THIS PURPOSE CCW WILL BE USED INSTEAD

2. SIMILAR FOR LOOP"B"

SERVIC



AMENDMENT 9

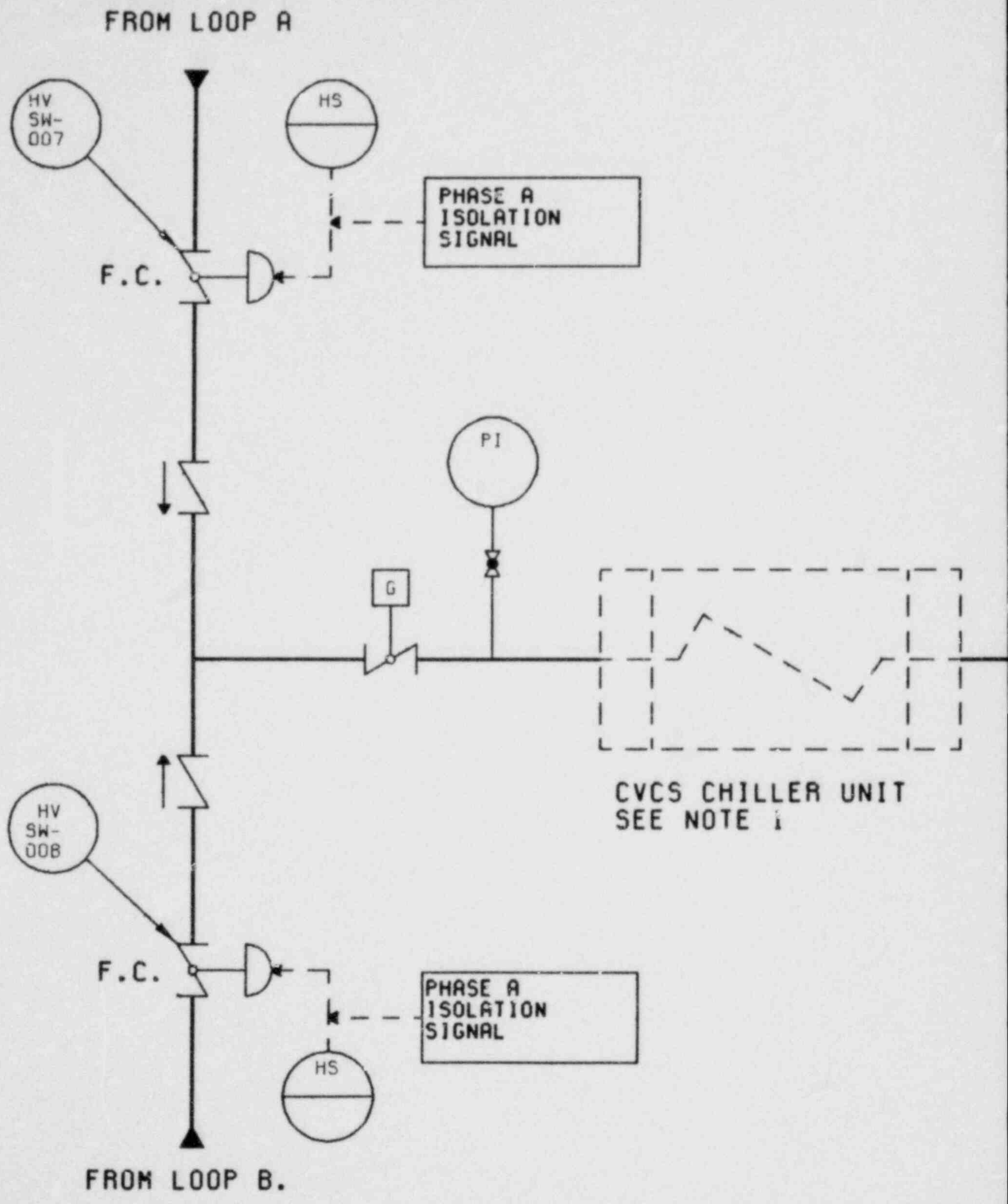
E WATER SYSTEM
(LOOP A)

GIBBSSAR

NSSS:
NOT SPECIFIC ☐
W-414 ☒
CE ☐
B & W ☐

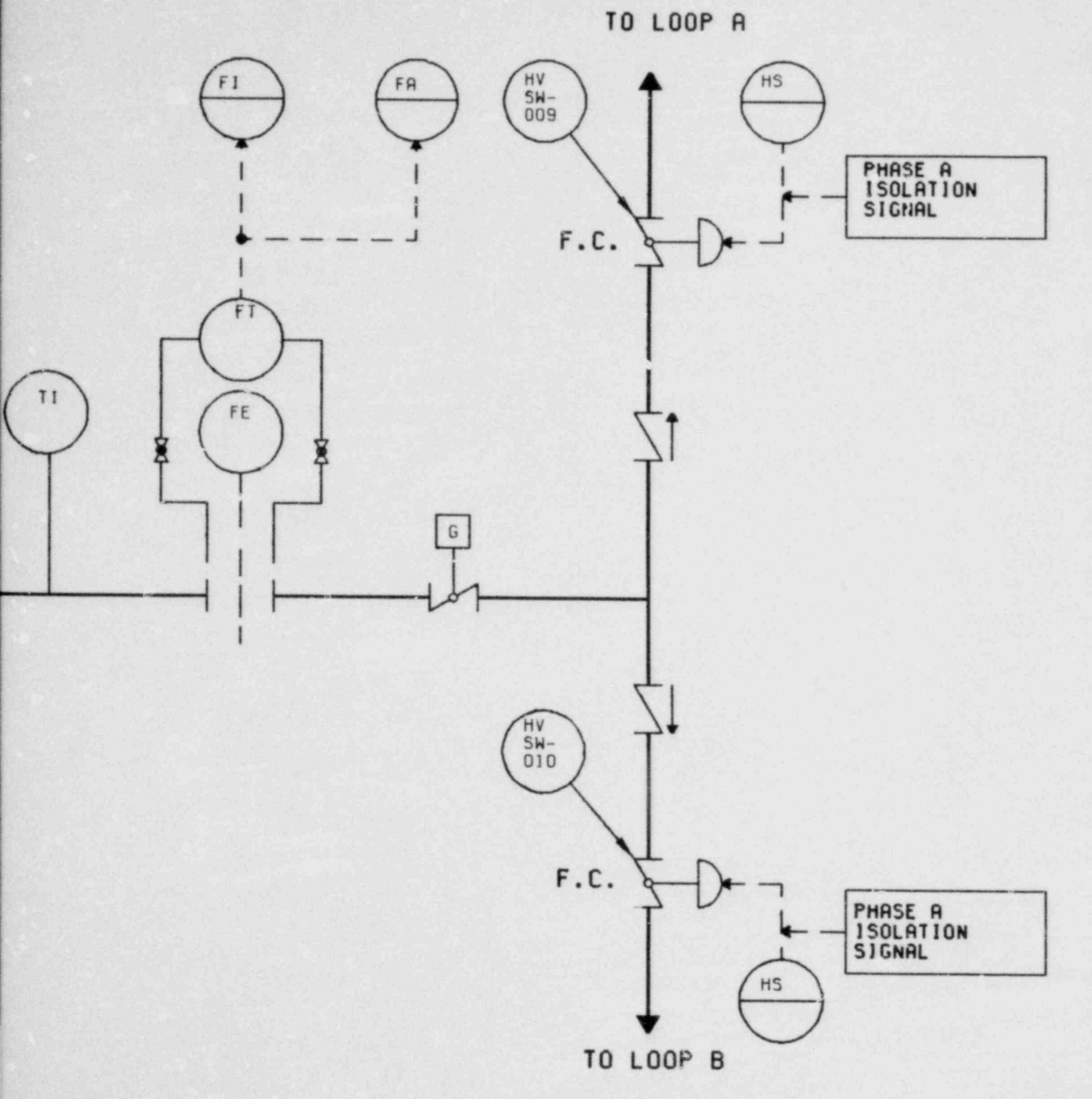
INSTRUMENTATION AND CONTROL SYSTEM DIAGRAM

FIGURE NO. 7.3-1 SH.1C.



FROM LOOP A
HV SW-007
HS
PHASE A ISOLATION SIGNAL
F.C.
PI
G
CVCS CHILLER UNIT SEE NOTE 1
HV SW-008
F.C.
PHASE A ISOLATION SIGNAL
HS
FROM LOOP B.

SERVICE



AMENDMENT 9

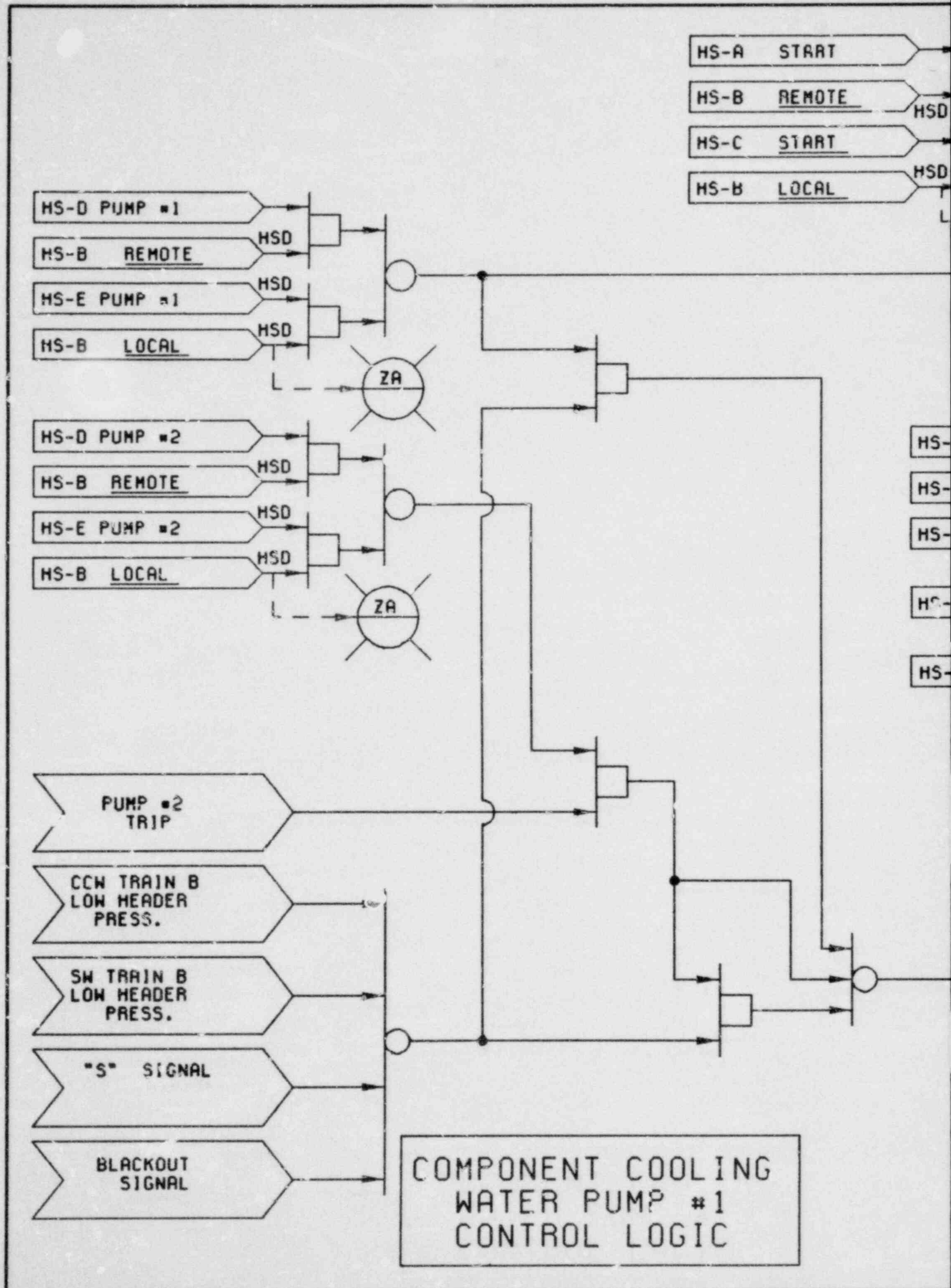
WATER SYSTEM

GIBBSSAR

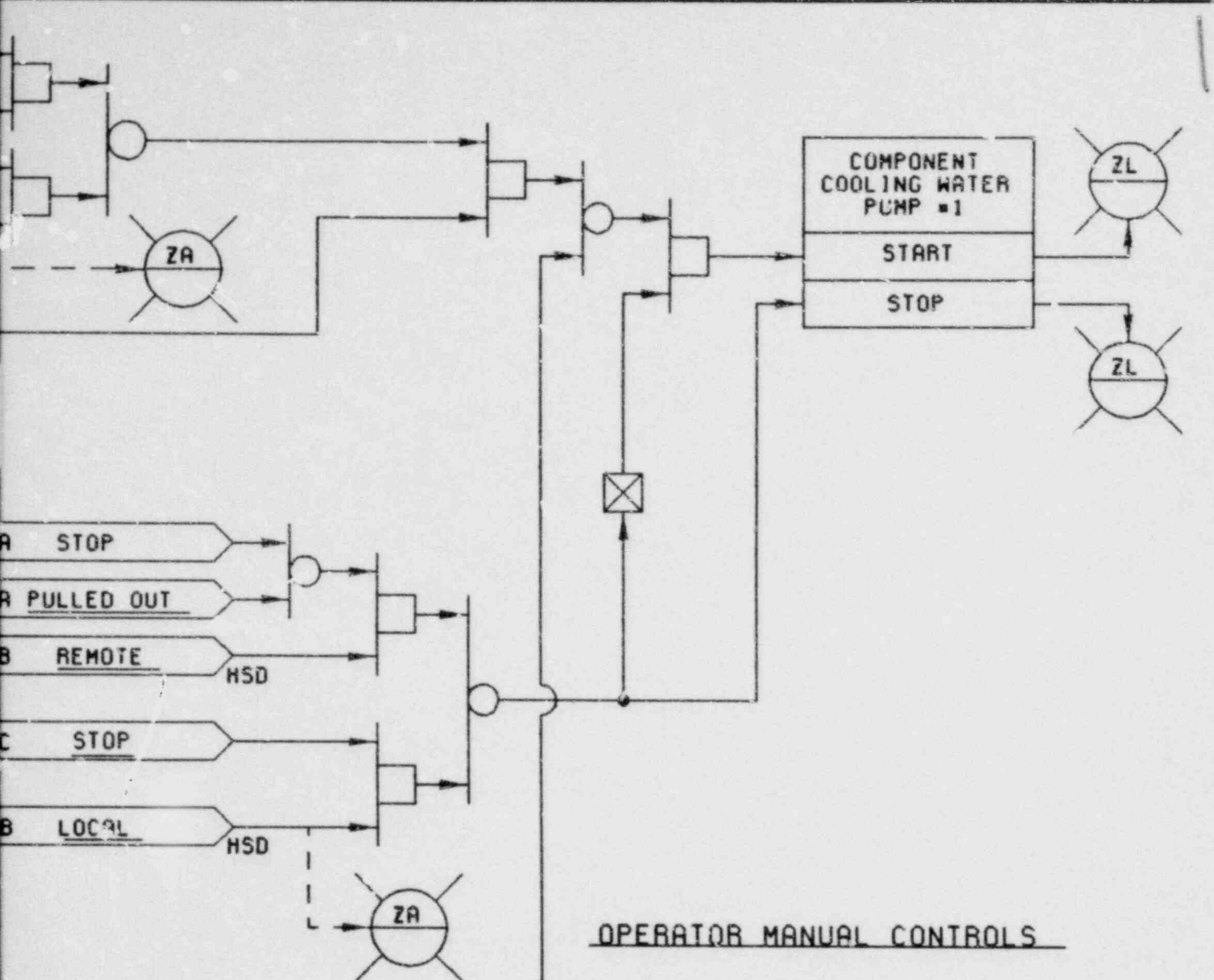
NSSS:
NOT SPECIFIC ☐
W-414 ☒
CE ☐
B & W ☐

INSTRUMENTATION AND CONTROL SYSTEM DIAGRAM

FIGURE NO. 7.3-1 SH.1D.



COMPONENT COOLING WATER PUMP #1 CONTROL LOGIC



OPERATOR MANUAL CONTROLS

HS-E
HS-D PUMP #1 —— PUMP #2

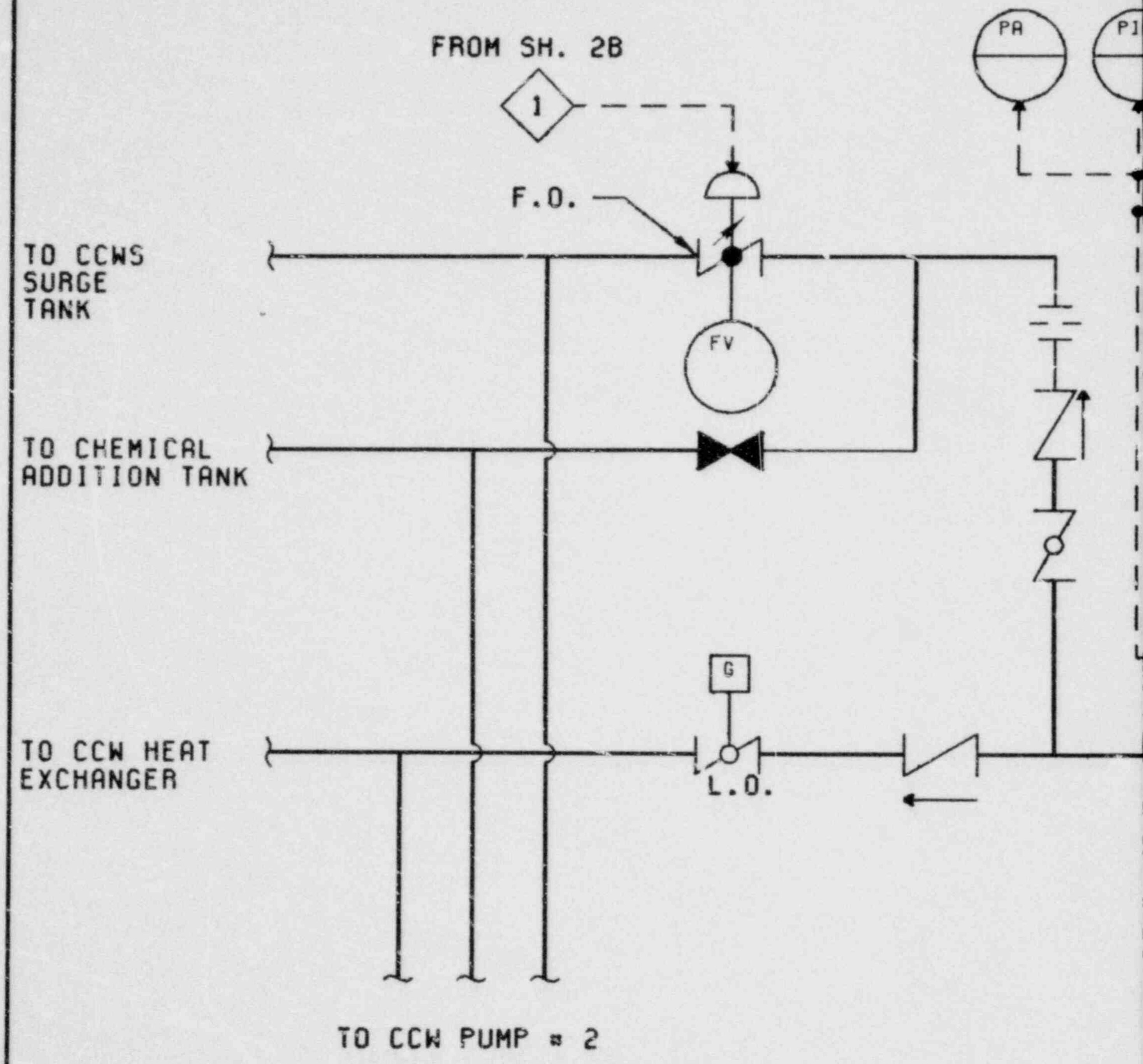
HS-B LOCAL —— REMOTE

HS-A START → AUTO ← STOP —— PULLED OUT

HS-C START —— STOP

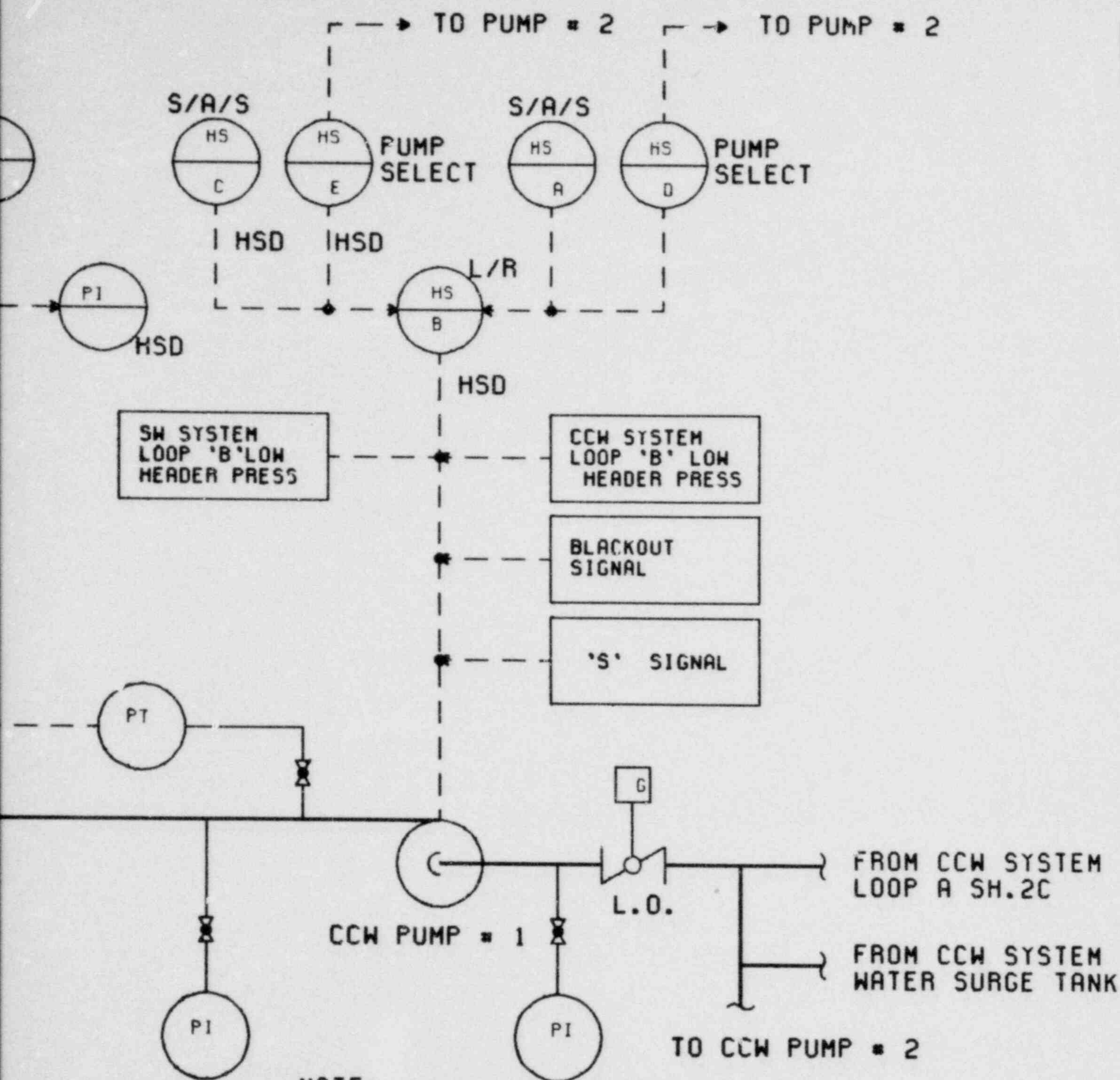
AMENDMENT 9

GIBBSSAR	INSTRUMENTATION AND CONTROL SYSTEM LOGIC DIAGRAM
NSSS: ☐ NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.2



COMPONENT COOLI

(LO

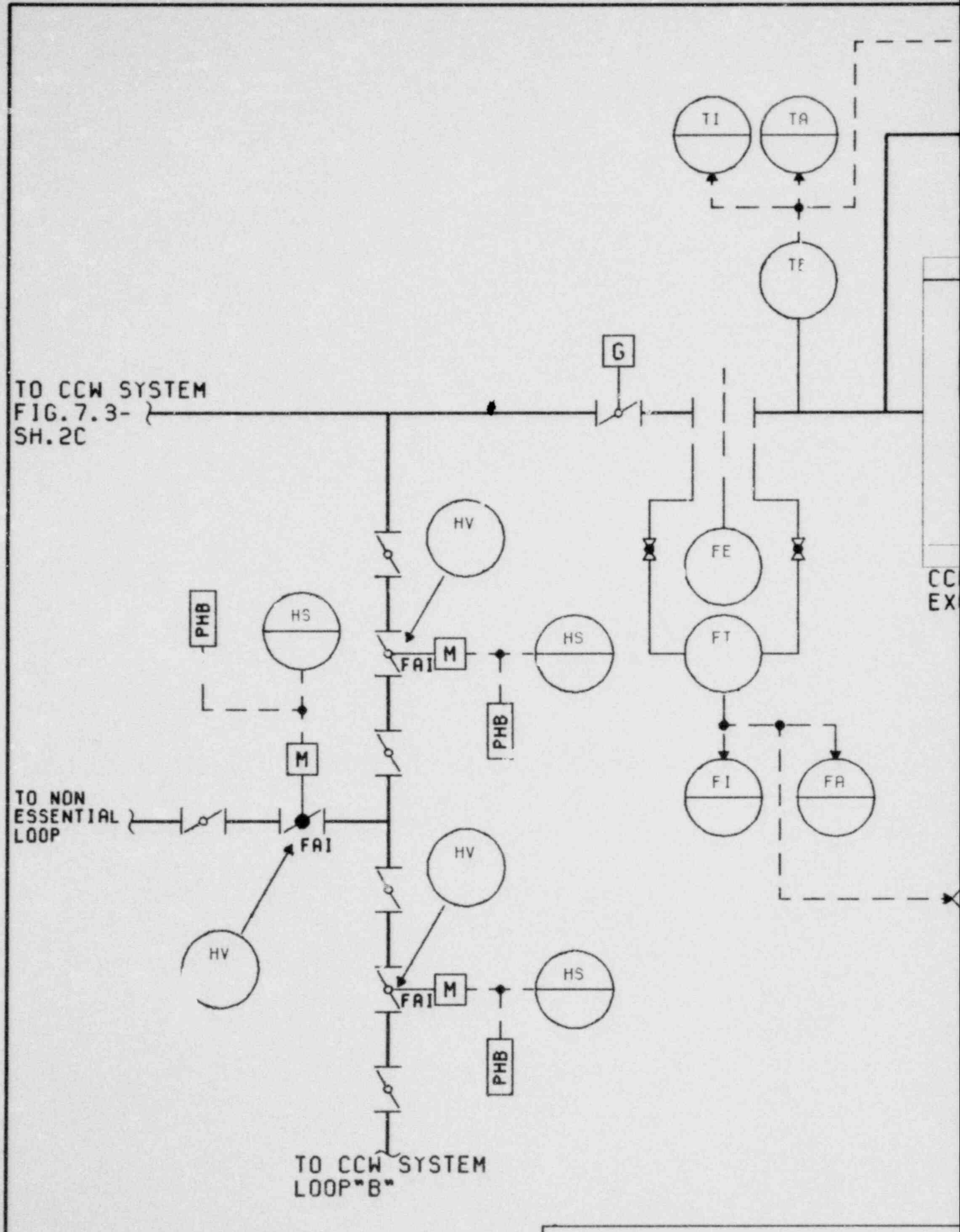


NOTE:
1. COMPONENT COOLING WATER PUMP # 1, LOOP A SHOWN-CCW PUMP # 2, LOOP A, SIMILAR
2. CCW PUMP # 3 & 4, LOOP B SIMILAR

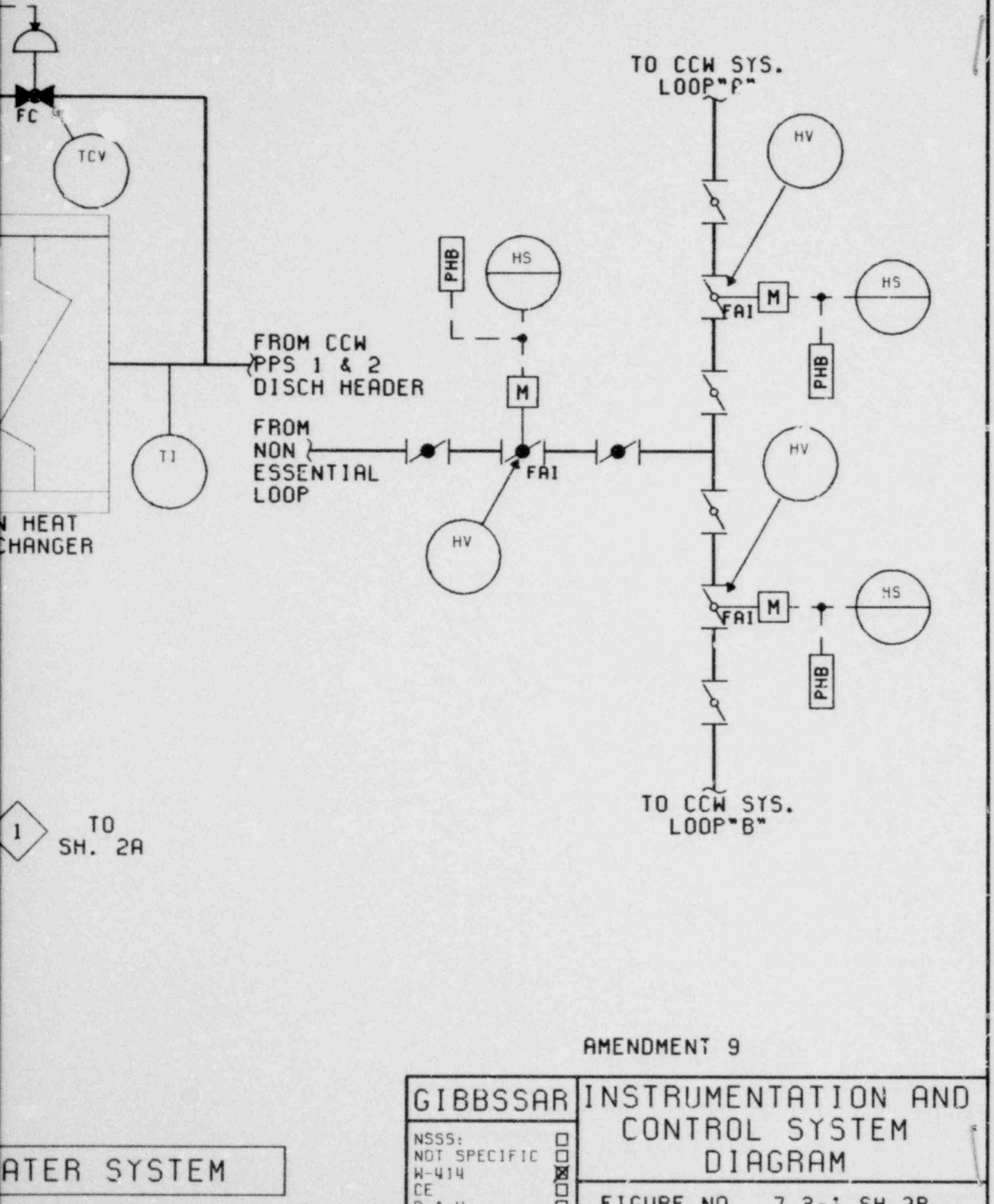
AMENDMENT 9

NG WATER SYSTEM
OP A)

GIBBSSAR	INSTRUMENTATION AND CONTROL SYSTEM DIAGRAM
NSSS: NOT SPECIFIC, W-414 (X), CE, B & W	FIGURE NO. 7.3-1 SH.2A

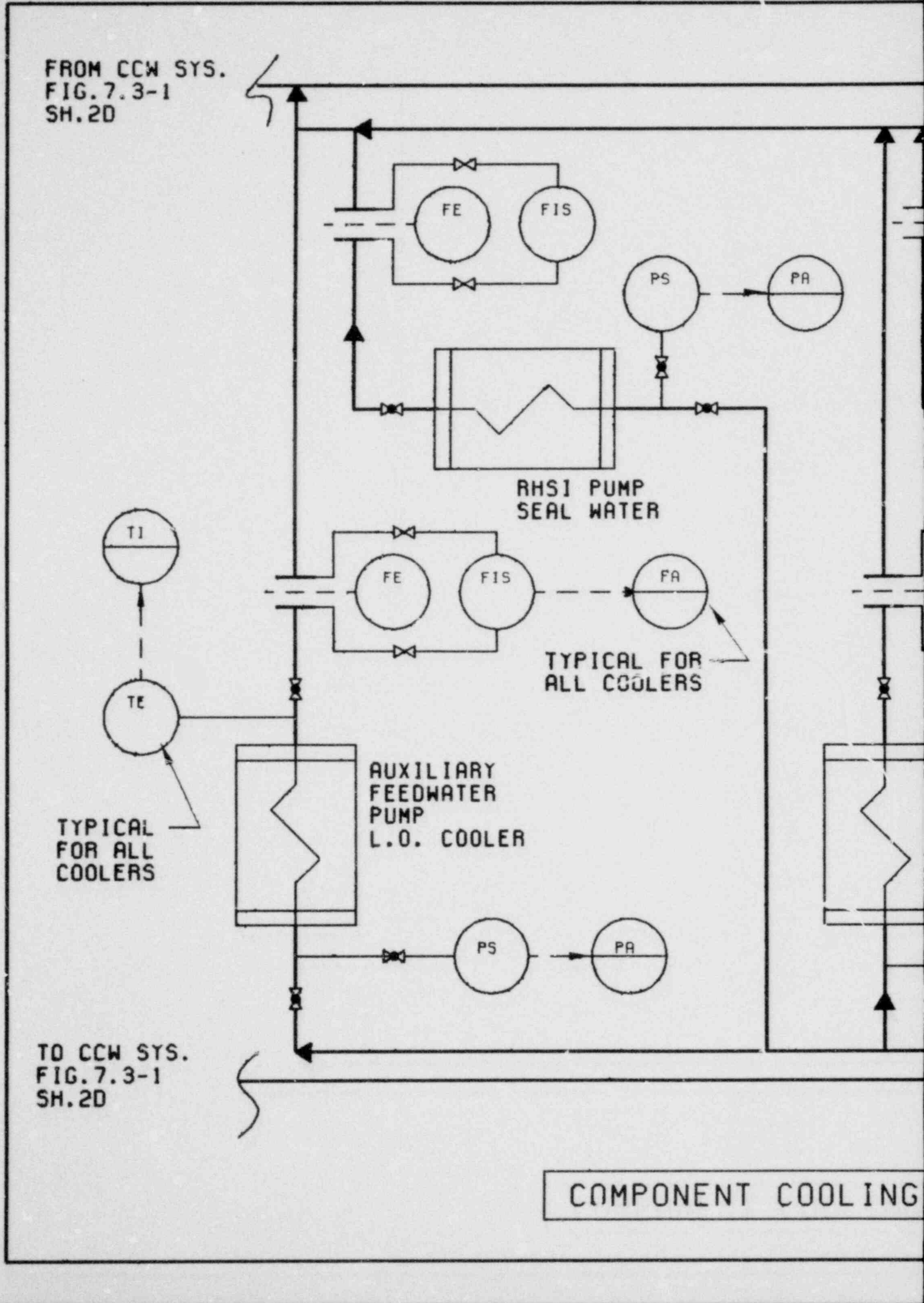


COMPONENT COOLING W

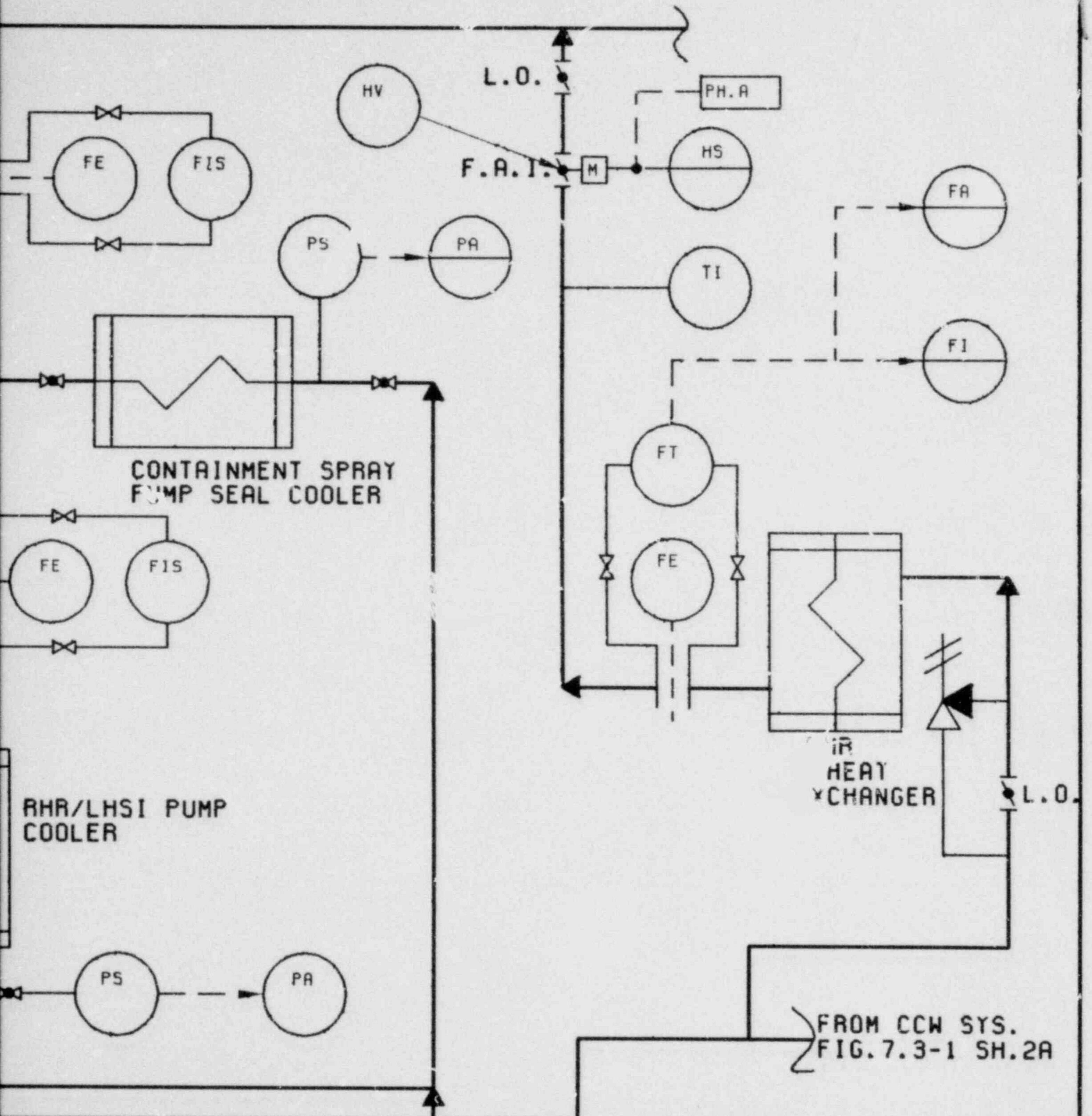


AMENDMENT 9

GIBBSSAR	INSTRUMENTATION AND CONTROL SYSTEM DIAGRAM
NSSS: ☐ NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.2B.



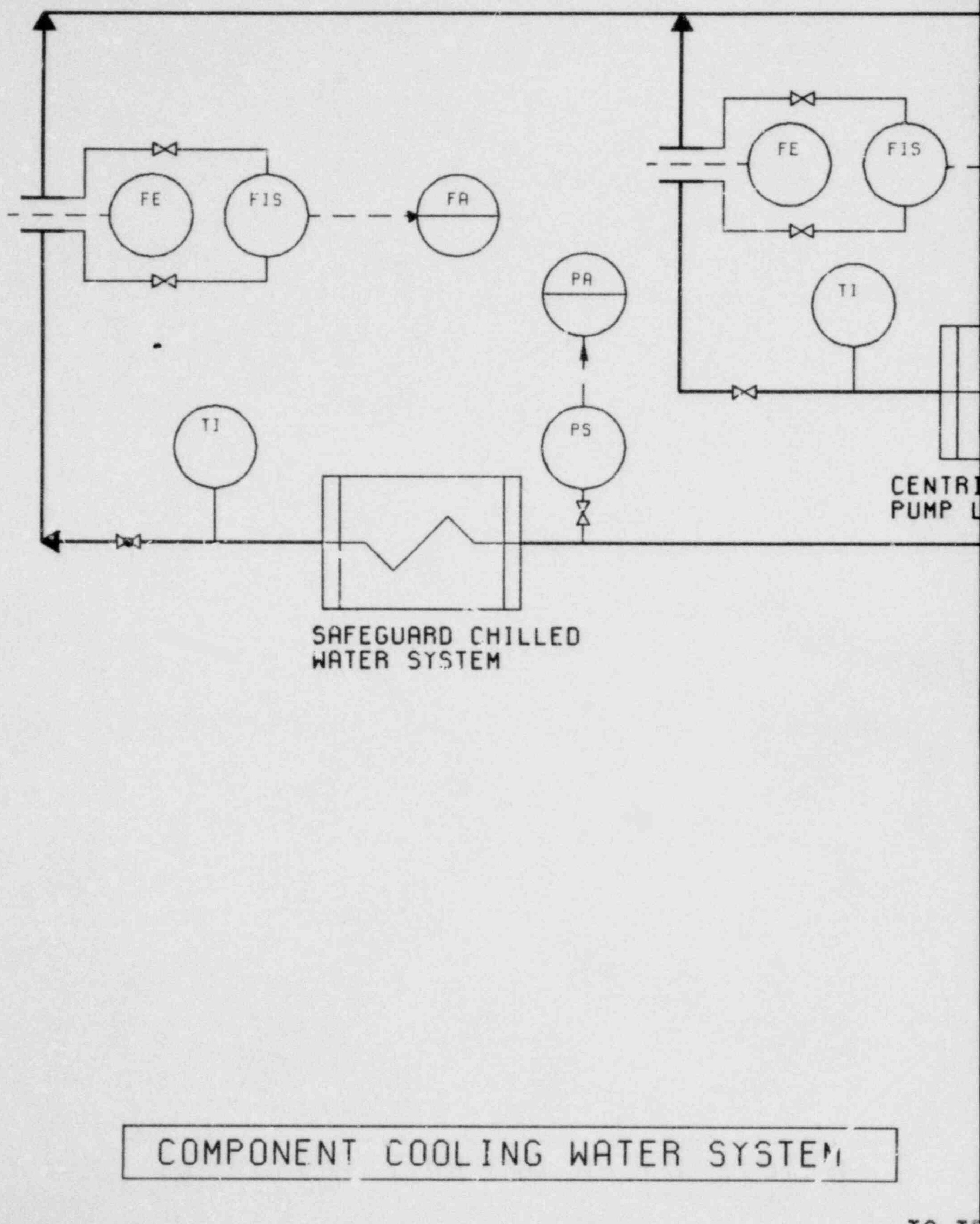
COMPONENT COOLING



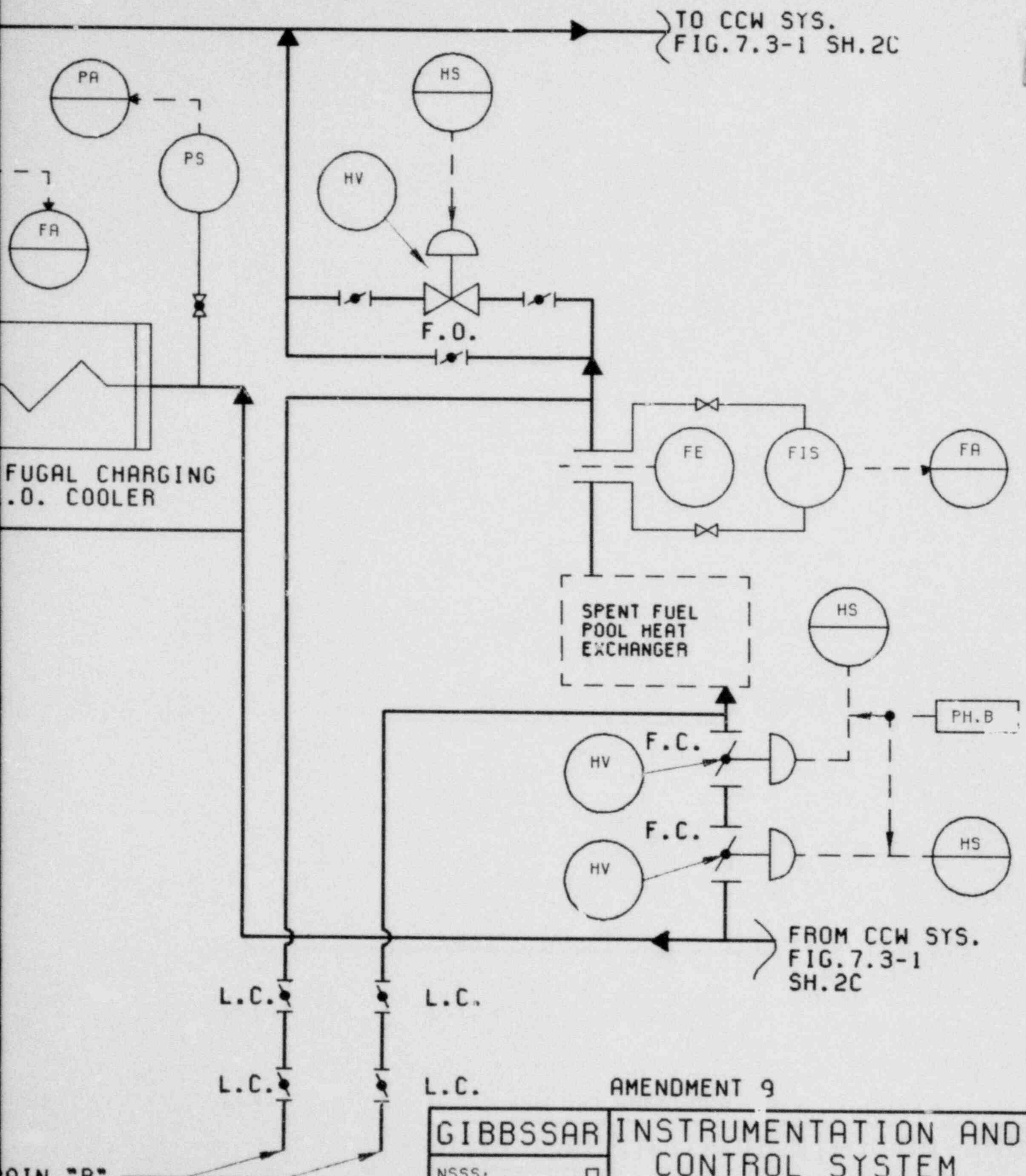
AMENDMENT 9

WATER SYSTEM

GIBBSSAR	INSTRUMENTATION AND CONTROL SYSTEM DIAGRAM
NSSS: ☐ NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.2C

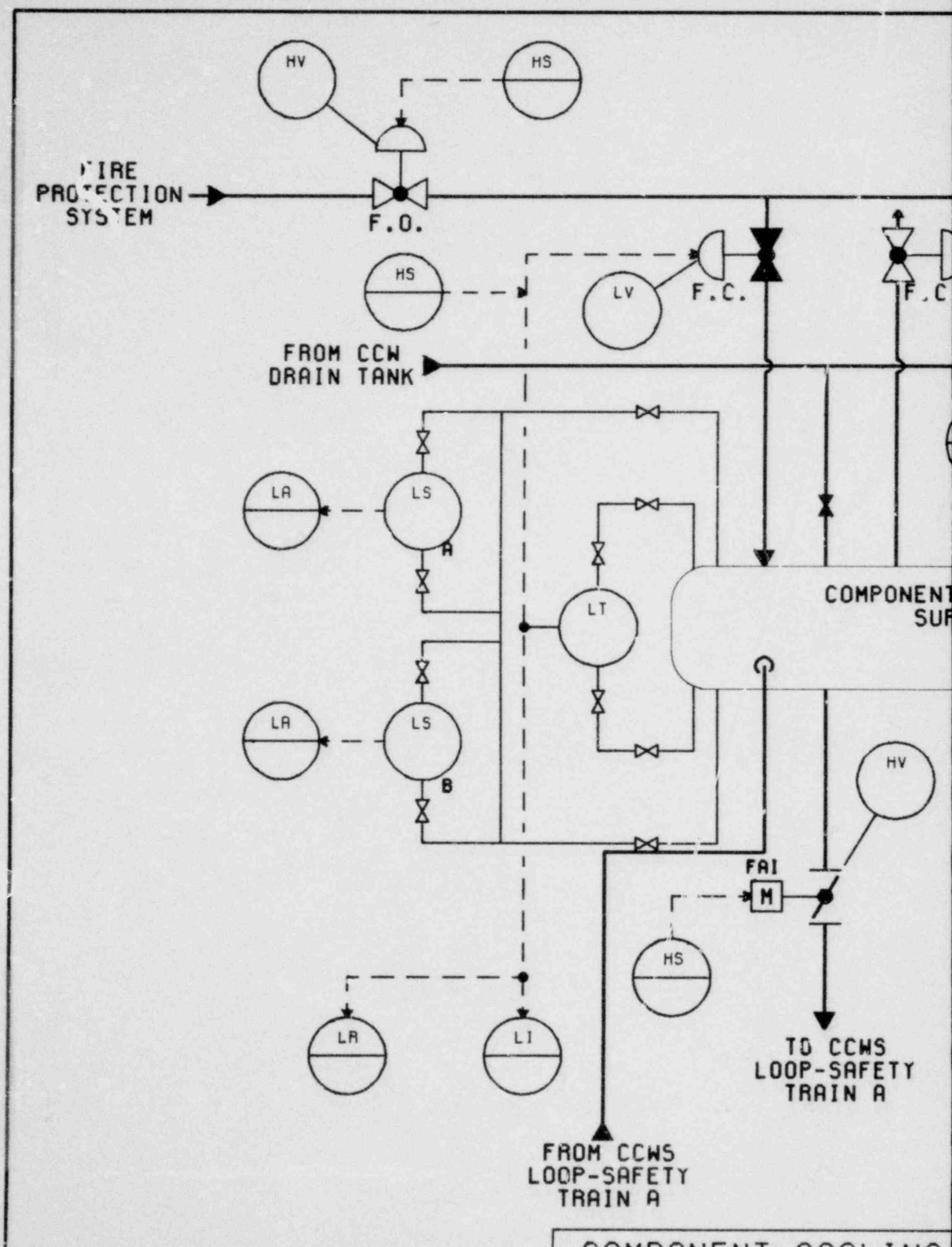


COMPONENT COOLING WATER SYSTEM

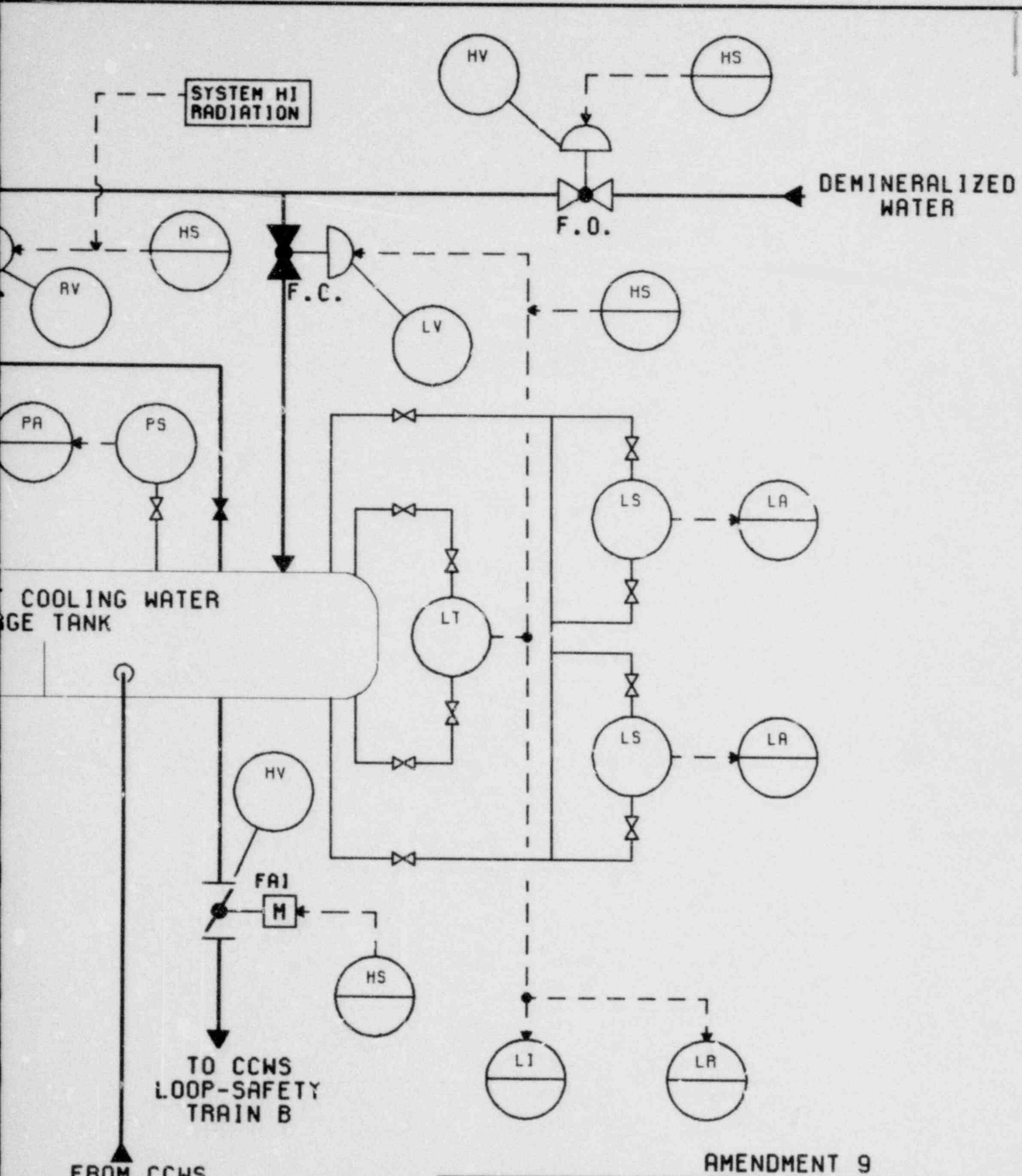


AMENDMENT 9

GIBBSSAR	INSTRUMENTATION AND CONTROL SYSTEM DIAGRAM
NSSS: ☐ NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.2D



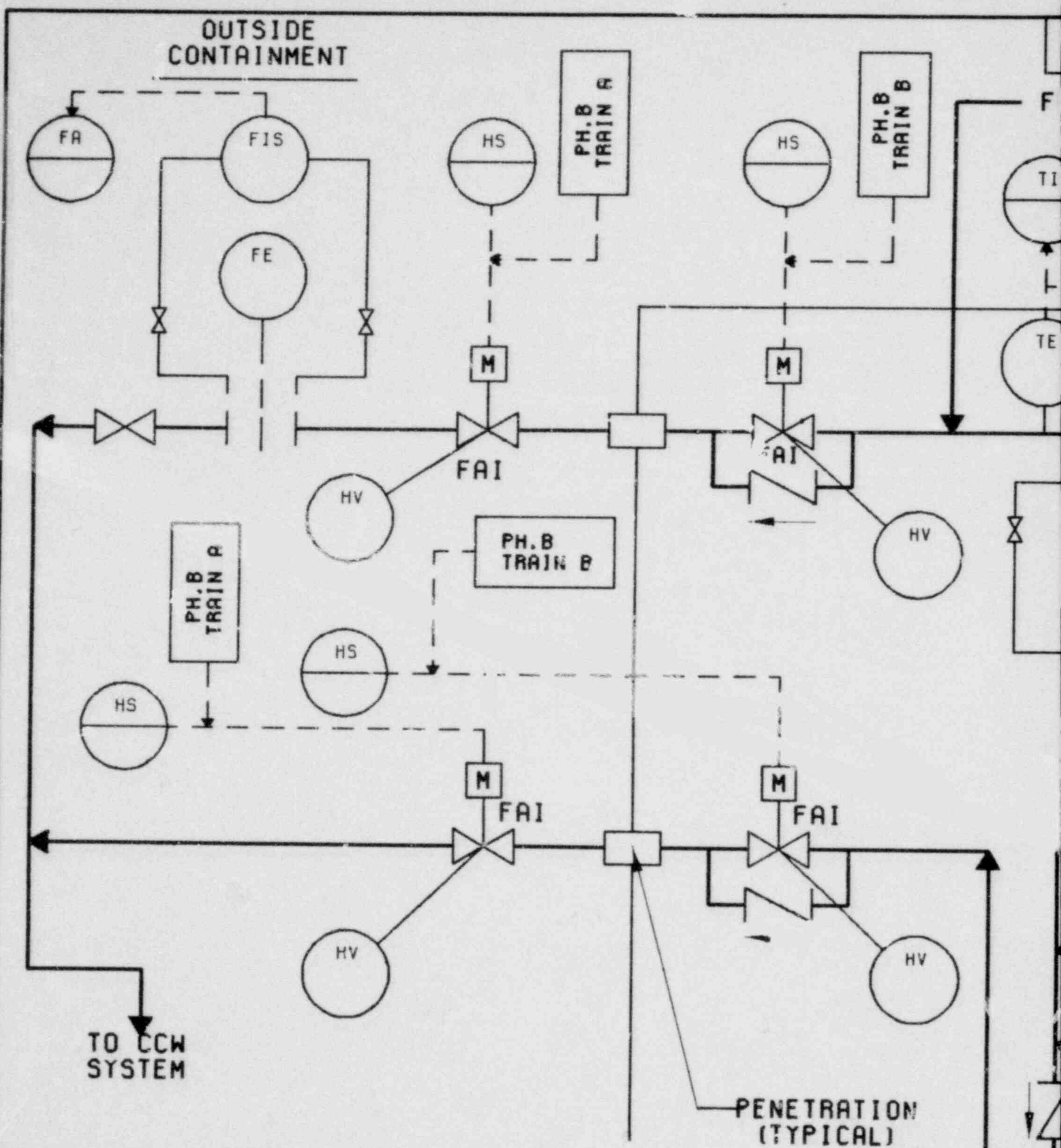
COMPONENT COOLING



WATER SYSTEM

AMENDMENT 9

GIBBSSAR	INSTRUMENTATION AND CONTROL SYSTEM DIAGRAM
NSSS: ☐ NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.2E

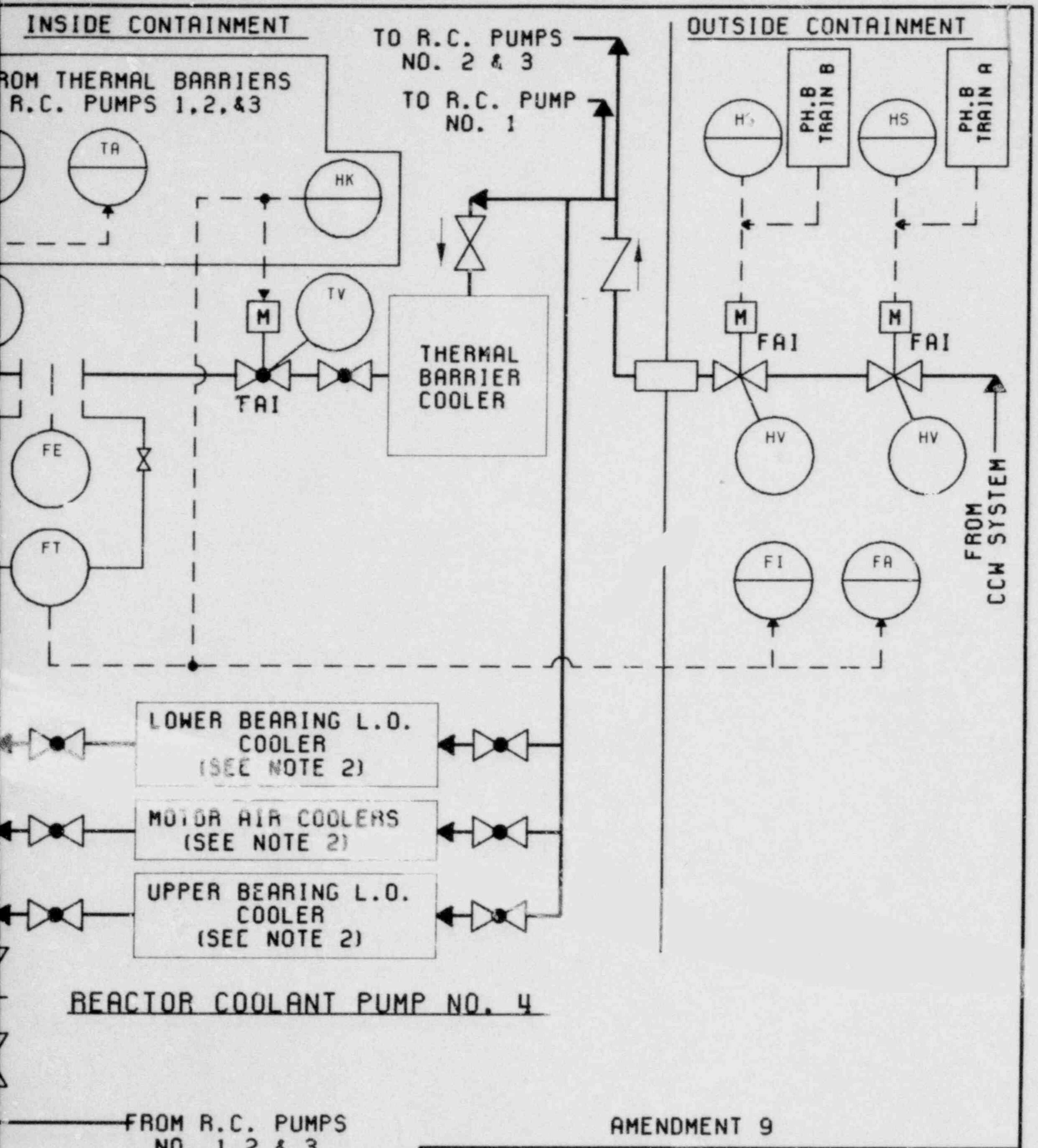


NOTE:

1. REACTOR COOLANT PUMP NO. 4 SHOWN-REACTOR COOLANT PUMPS 1,2 & 3 SIMILAR

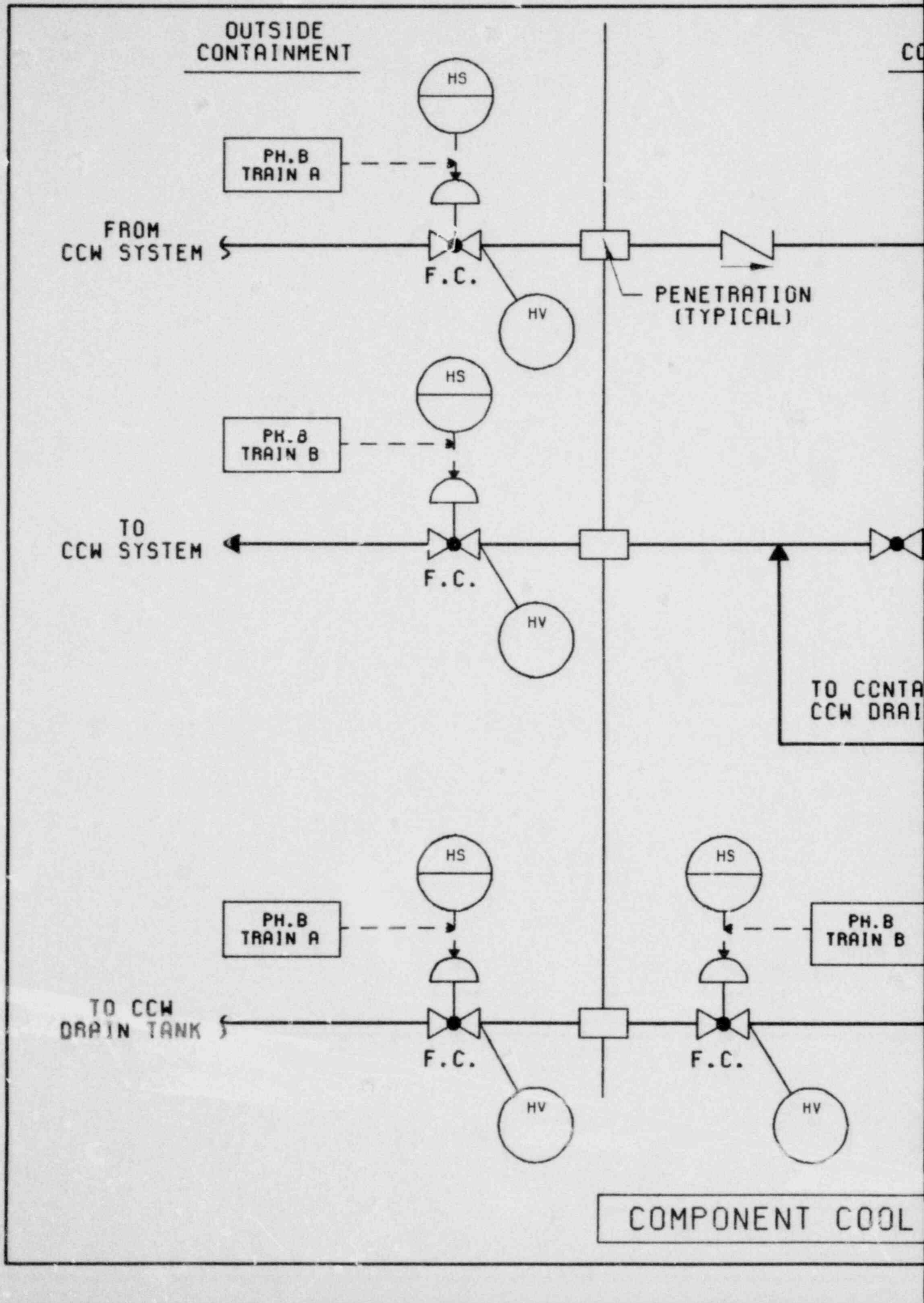
2. INSTRUMENTATION APPLICATION FOR MOTOR AIR COOLERS & UPPER & LOWER BEARING L.O. COOLERS SIMILAR TO THERMAL BARRIER COOLER.

COMPONENT COOLING W



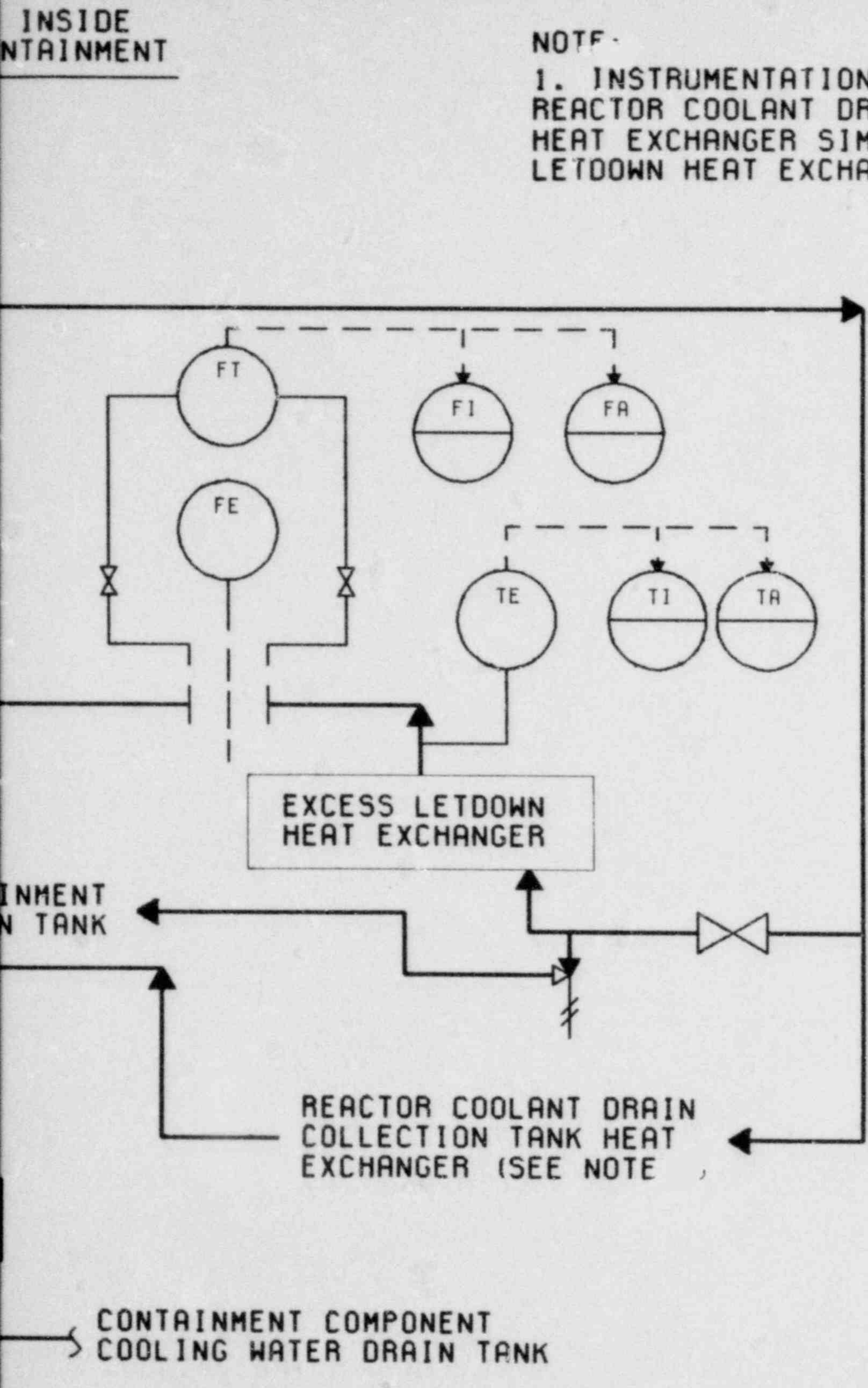
AMENDMENT 9

GIBBSSAR	INSTRUMENTATION AND CONTROL SYSTEM DIAGRAM
NSSS: ☐ NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.2F



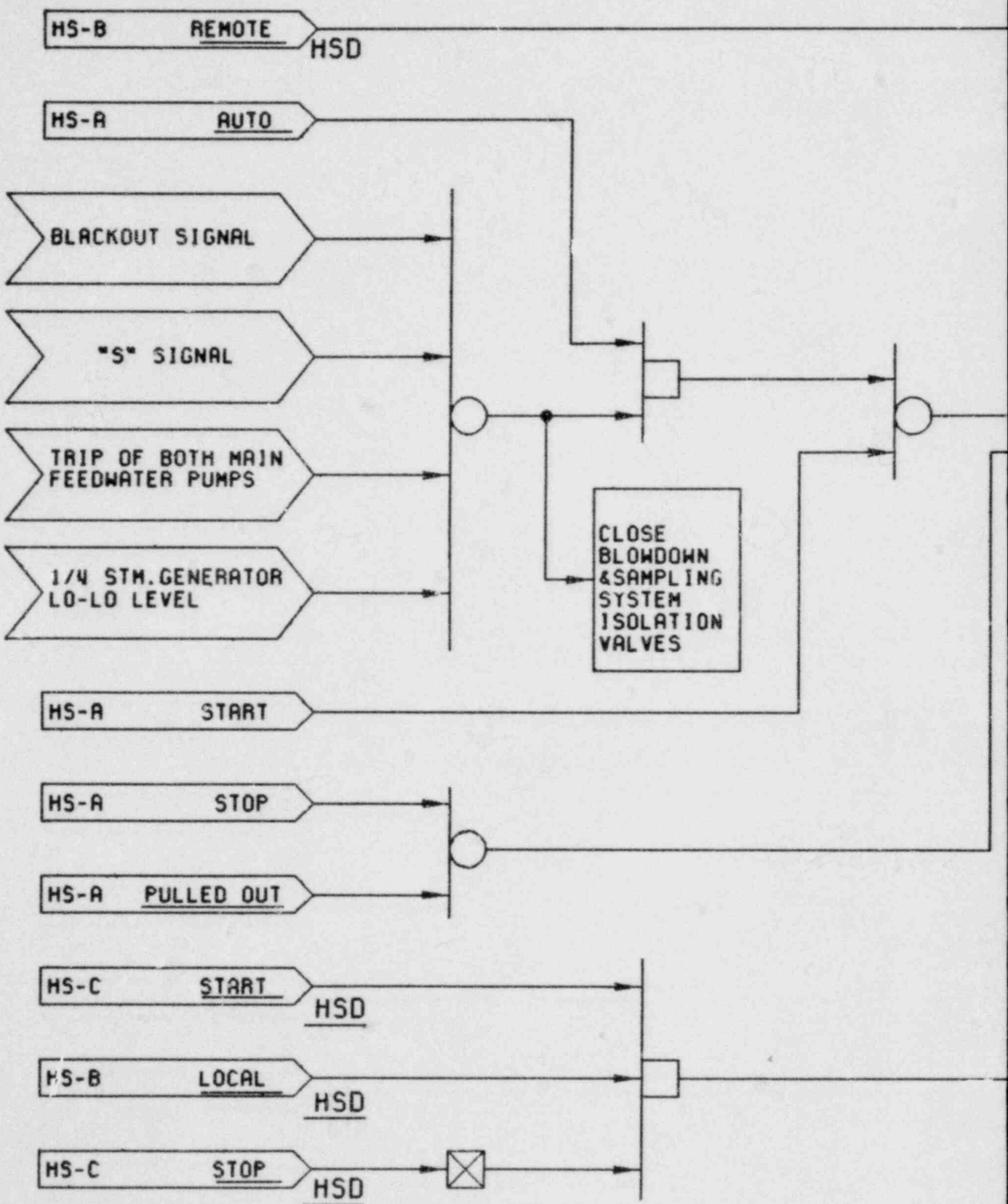
OUTSIDE CONTAINMENT
CO
HS
PH.B TRAIN A
FROM CCW SYSTEM
F.C.
HV
PENETRATION (TYPICAL)
HS
PH.B TRAIN B
TO CCW SYSTEM
F.C.
HV
TO CCNTA
CCW DRAI
HS
PH.B TRAIN A
TO CCW DRAIN TANK
F.C.
HV
HS
PH.B TRAIN B
F.C.
HV
COMPONENT COOL

NOTE:
1. INSTRUMENTATION APPLICATION FOR REACTOR COOLANT DRAIN COLLECTION TANK HEAT EXCHANGER SIMILAR TO EXCESS LETDOWN HEAT EXCHANGER

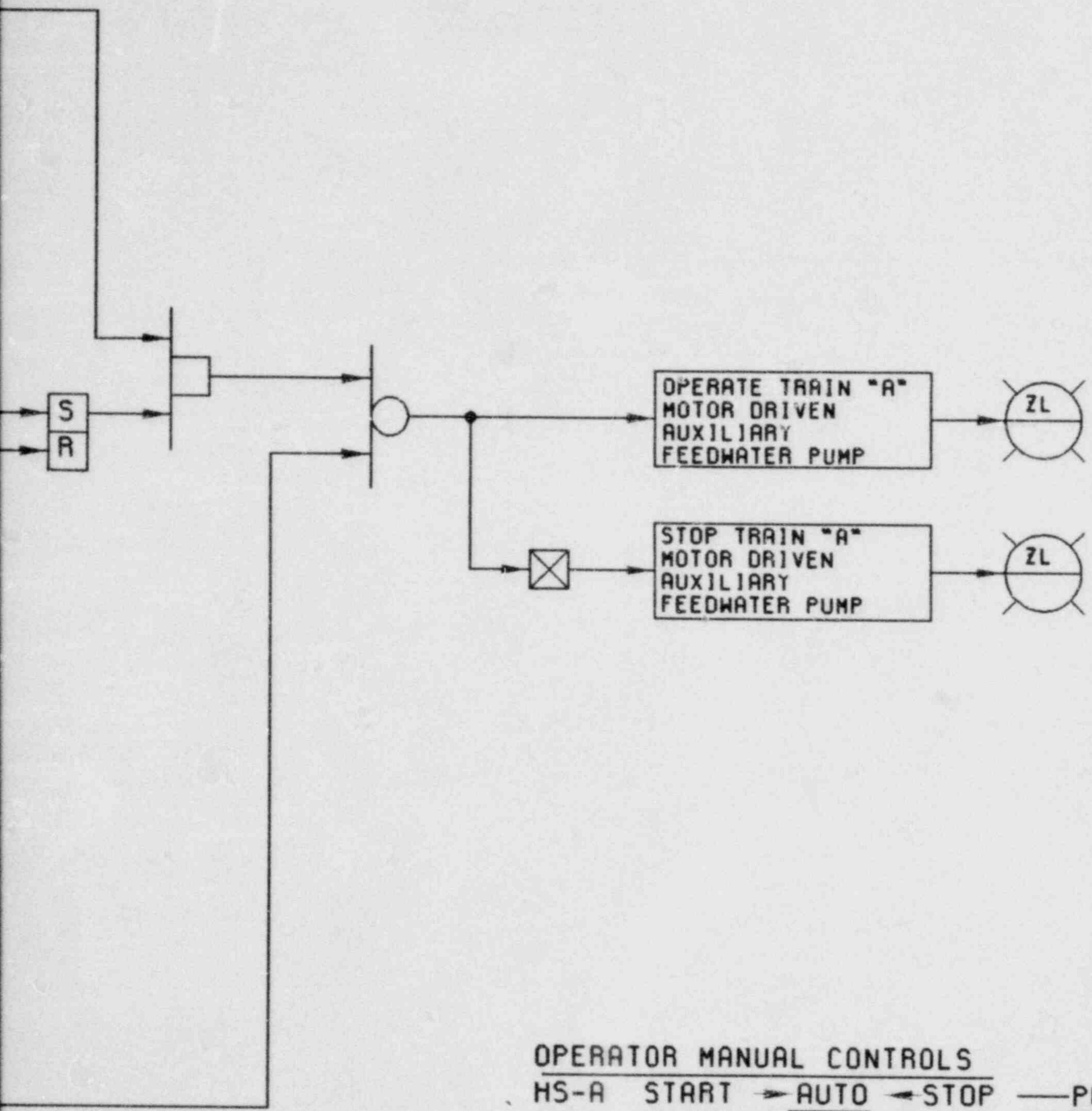


AMENDMENT 9

GIBBSSAR	INSTRUMENTATION AND CONTROL SYSTEM DIAGRAM
NSSS: NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.2G



AUXILIARY FEEDWAT
DRIVEN PUMP TRAIN
TRAIN "B" PUMP S



OPERATOR MANUAL CONTROLS

HS-A START → AUTO ← STOP — PULLED OUT

HS-B REMOTE — LOCAL

HS-C START — STOP

AMENDMENT 9

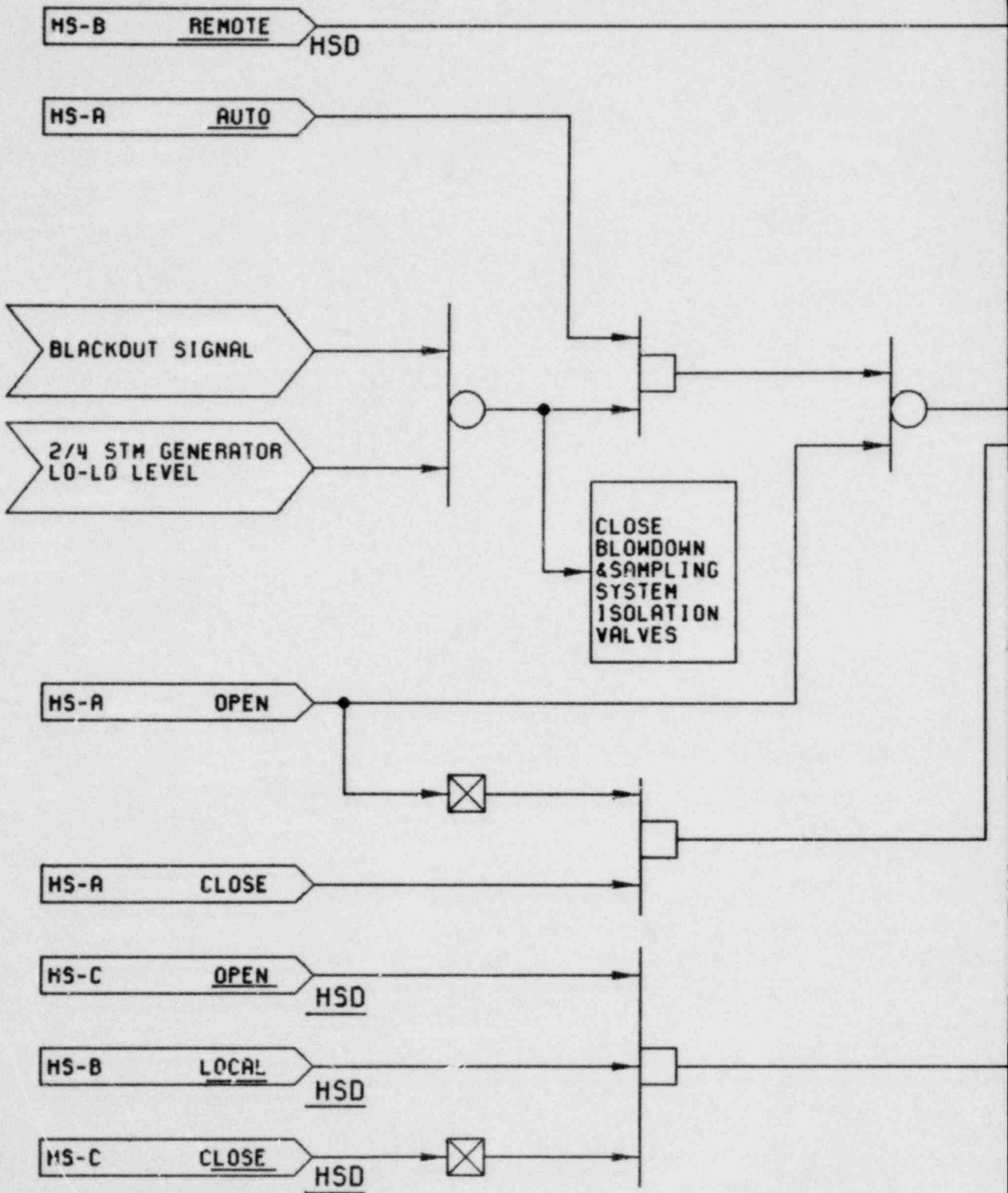
ER MOTOR
"A"
MILAR

GIBBSSAR

NSSS:
NOT SPECIFIC ☐
W-414 ☒
CE ☐
B & W ☐

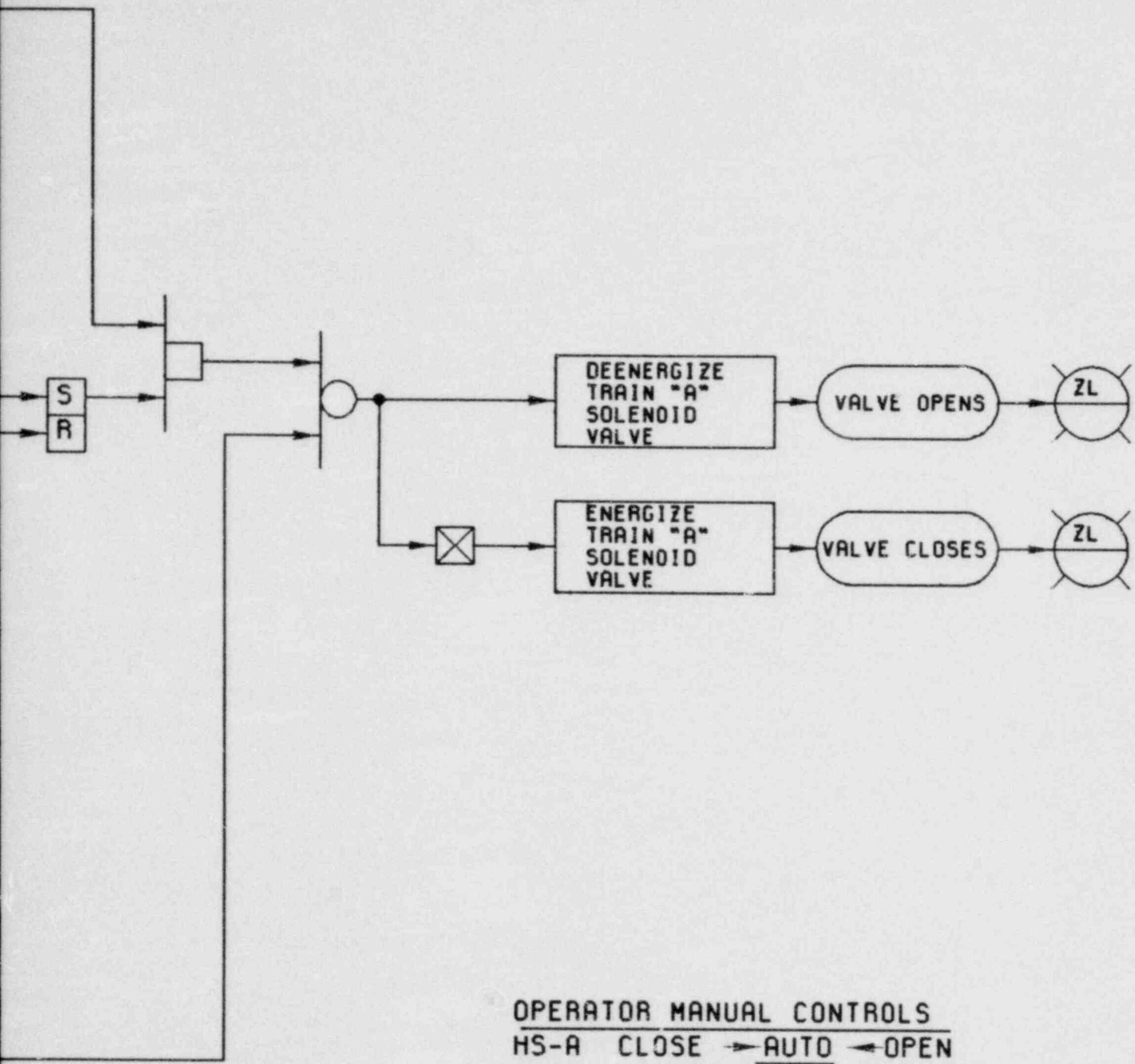
INSTRUMENTATION AND CONTROL SYSTEM LOGIC DIAGRAM

FIGURE NO. 7.3-1 SH.10



NOTES:
1. SIMULTANEOUS OPERATION OF BOTH HANDSWITCHES IS REQUIRED TO OPEN THIS VALVE.

AUXILIARY FEEDWAT
DRIVEN PUMP STEAM
TRAIN "A" (TRAIN



OPERATOR MANUAL CONTROLS

HS-A CLOSE → AUTO ← OPEN

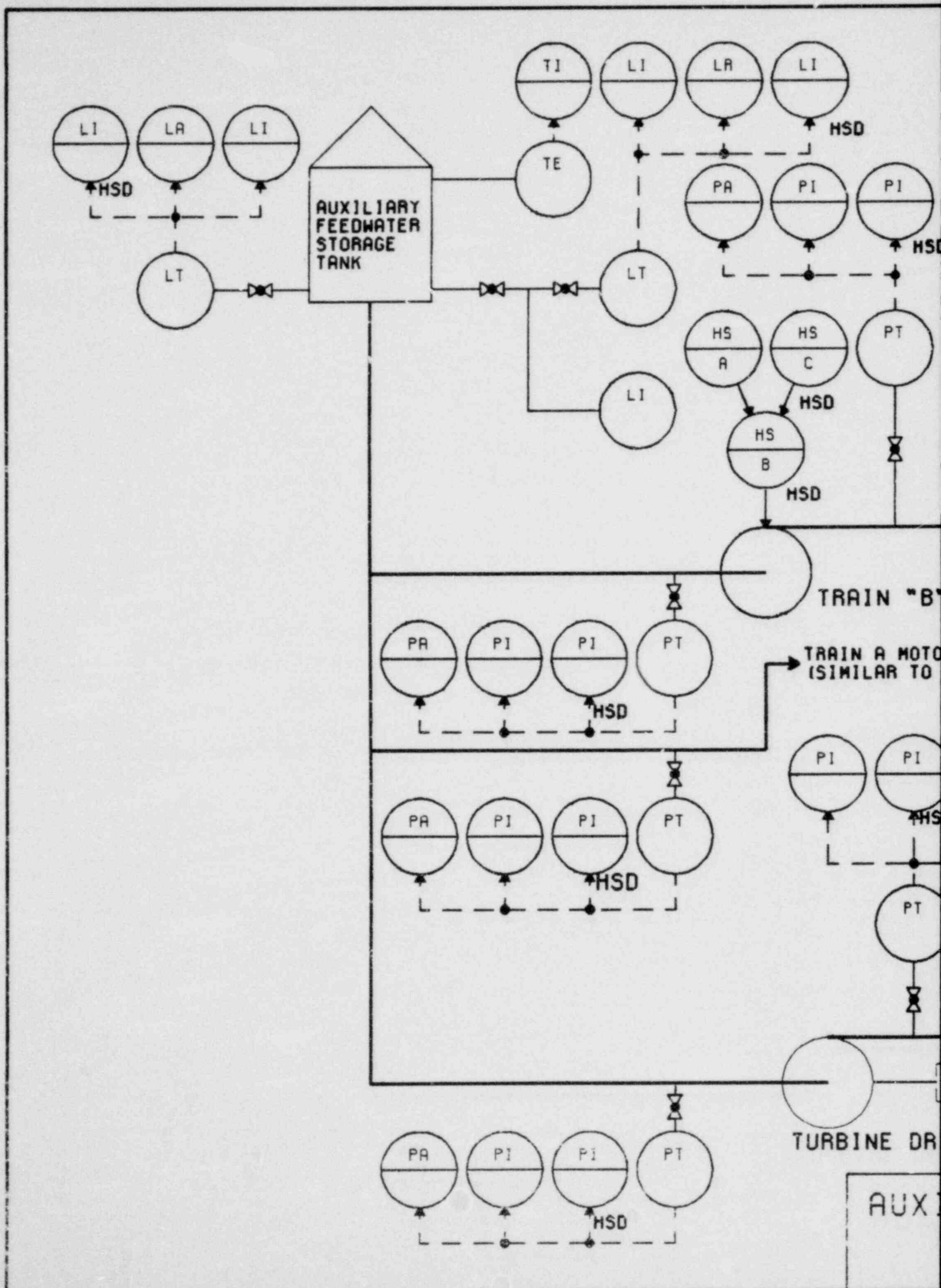
HS-B REMOTE —— LOCAL

HS-C CLOSE —— OPEN

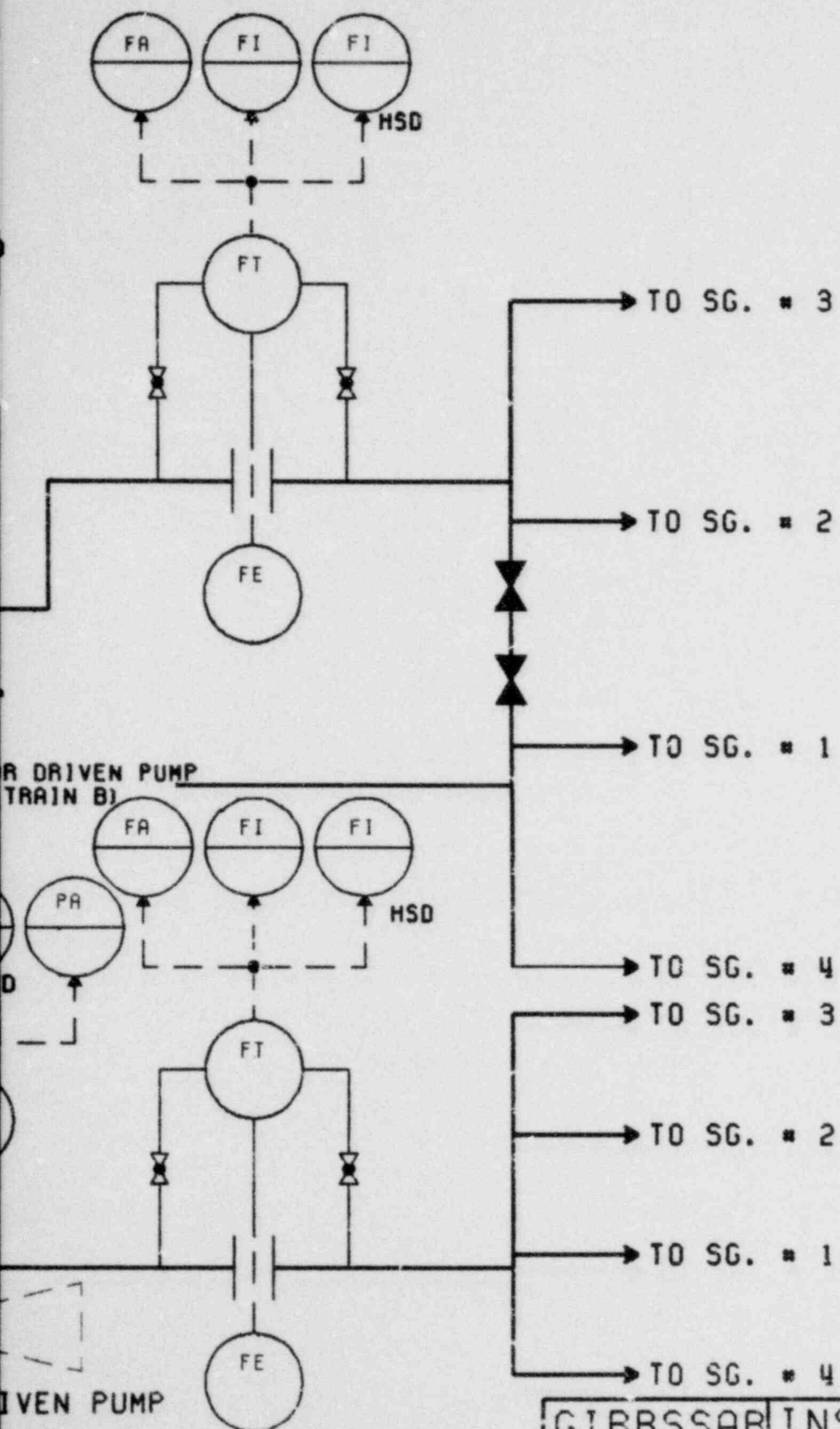
AMENDMENT 9

ER TURBINE
INLET VALVE
"B" SIMILAR)

GIBBSSAR	INSTRUMENTATION AND CONTROL SYSTEM LOGIC DIAGRAM
NSSS: NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.10A



LI
LA
LI
HSD
LT
AUXILIARY FEEDWATER STORAGE TANK
TI
LI
LR
LI
HSD
TE
PA
PI
PI
HSD
LT
HS A
HS C
PT
HSD
LI
HS B
HSD
TRAIN "B"
TRAIN A MOTO
(SIMILAR TO
PA
PI
PI
PT
HSD
PI
PI
PA
PI
PI
PT
HSD
PT
TURBINE DR
PA
PI
PI
PT
HSD
AUXI



AMENDMENT 9

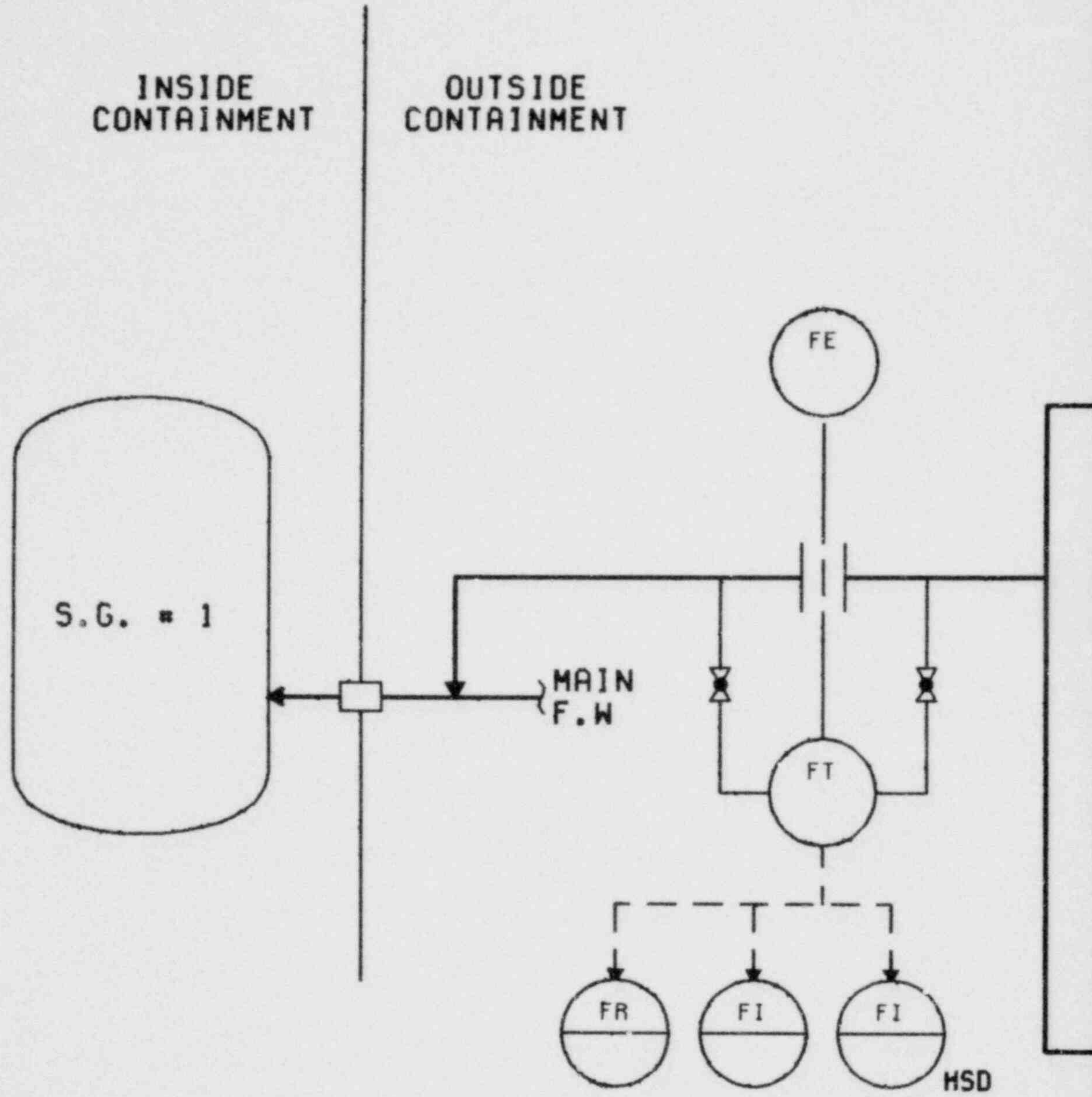
ILIARY FEEDWATER SYSTEM

GIBBSSAR

NSSS:
NOT SPECIFIC
W-414
CE
B & W

INSTRUMENTATION AND CONTROL SYSTEM DIAGRAM

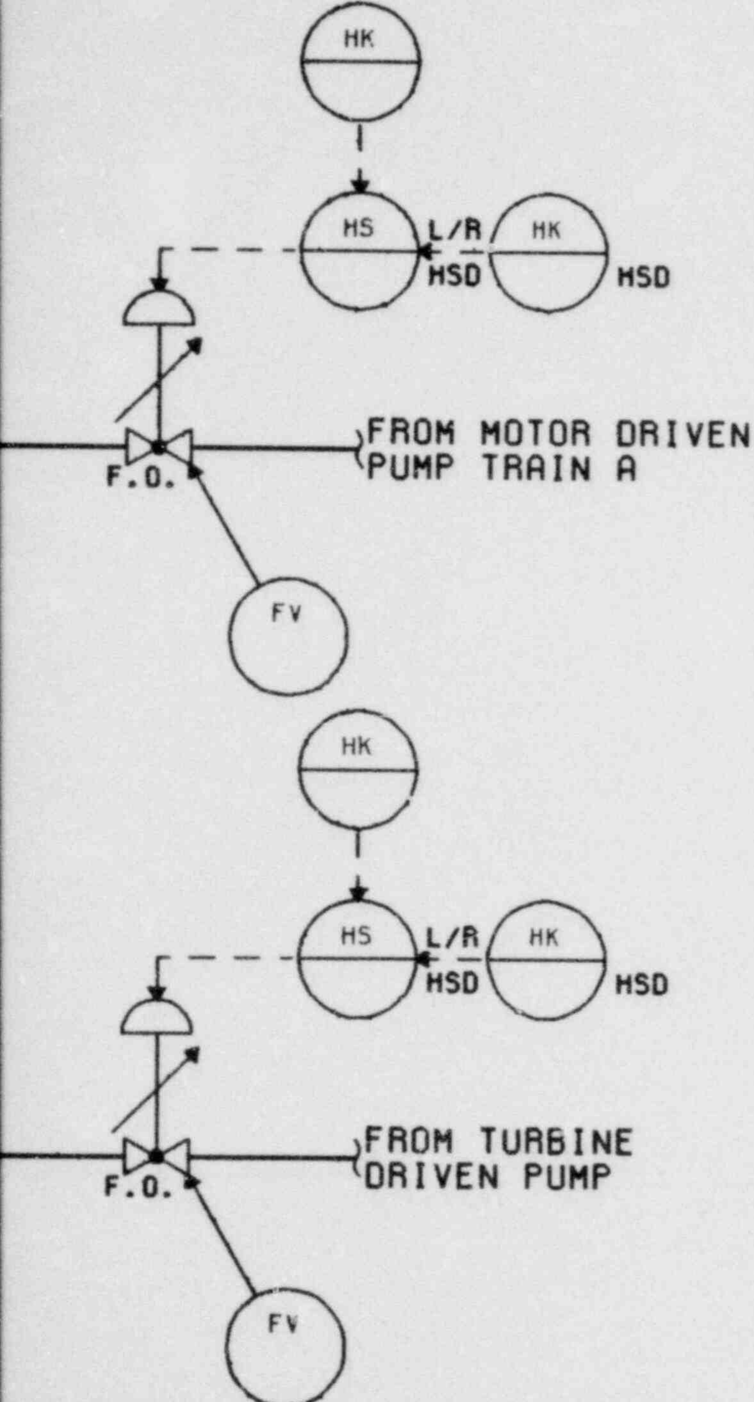
FIGURE NO. 7.3-1 SH.10B



NOTE:

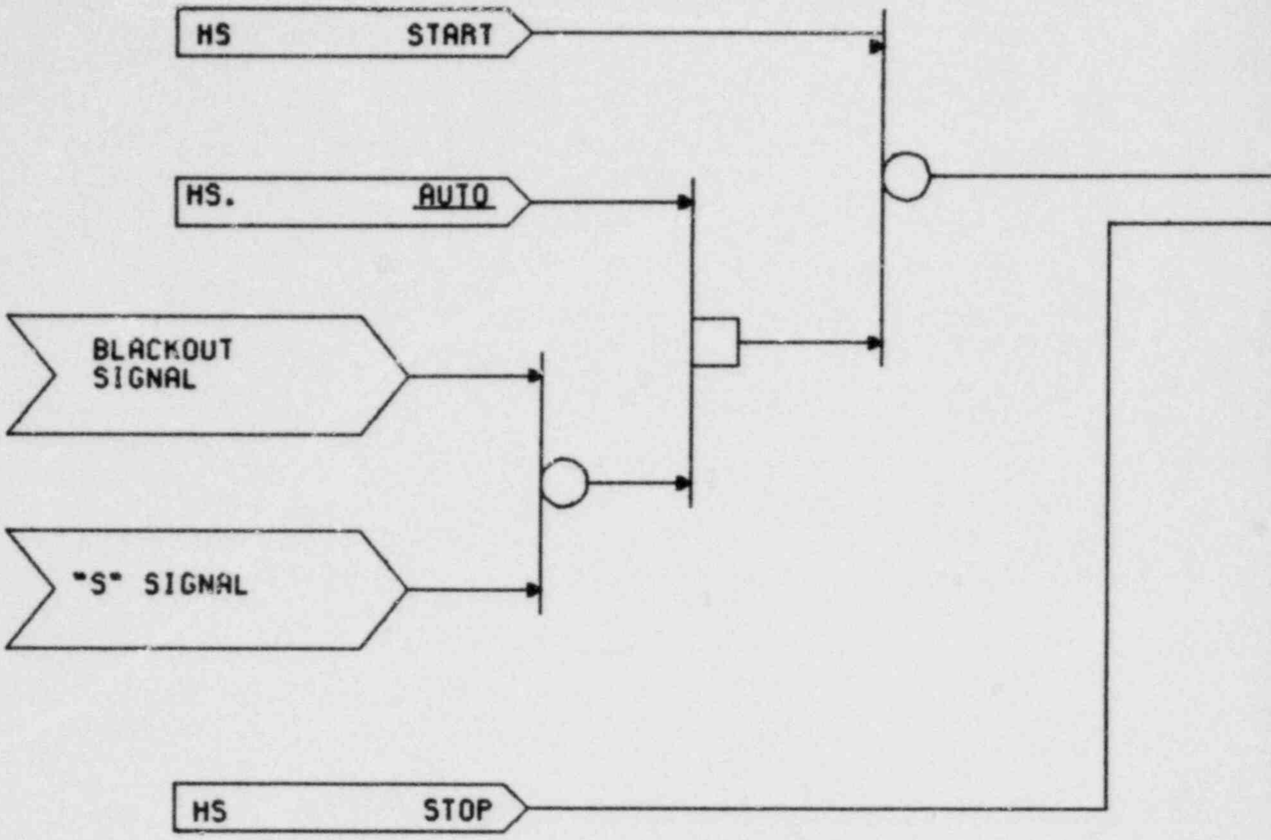
1. S.G. ■ 2, S.G. ■ 3 AND
S.G. ■ 4 SIMILAR TO S.G. ■ 1

AUXI

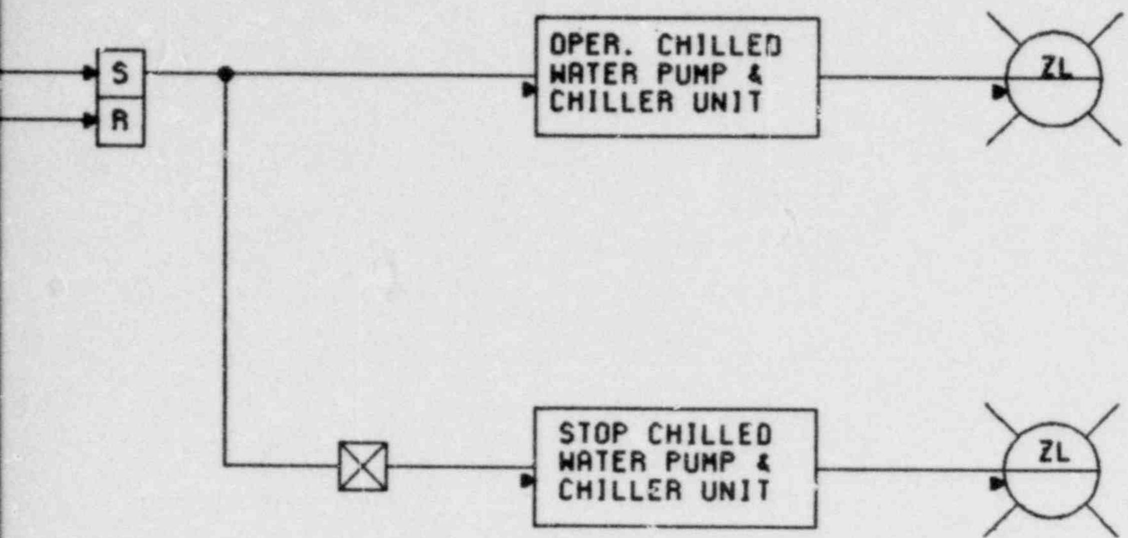


AMENDMENT 9

LIARY FEEDWATER SYSTEM	GIBBSSAR	INSTRUMENTATION AND CONTROL SYSTEM DIAGRAM
	NSSS: ☐ NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.10C



VENTILATION SA
CHILLED WATER
(3 OTHER PUMPS SIMILA



OPERATOR MANUAL CONTROLS

HS- START → AUTO ← STOP PULLED OUT

AMENDMENT 9

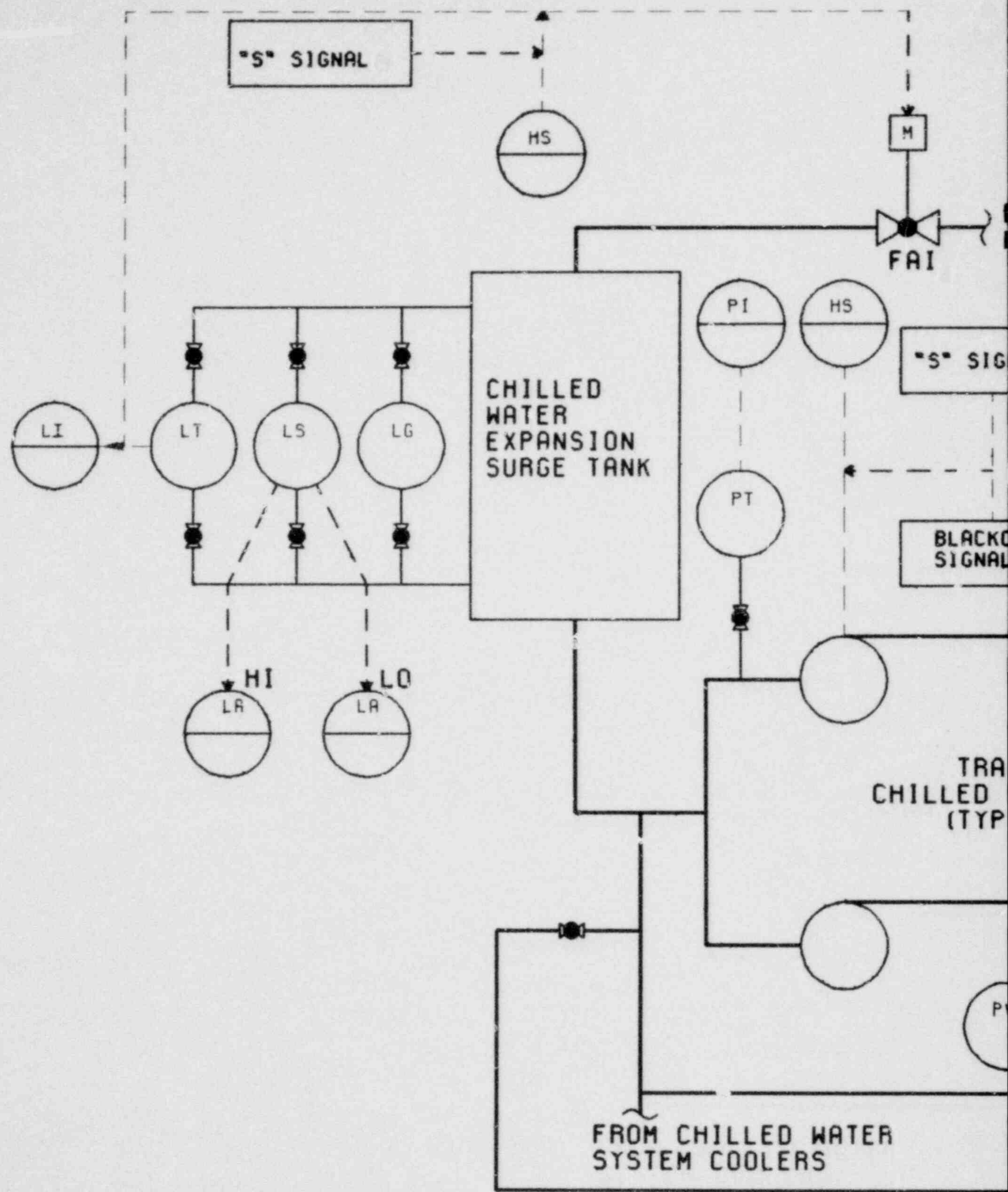
FETY FEATURES
PUMP
R)

GIBBSSAR

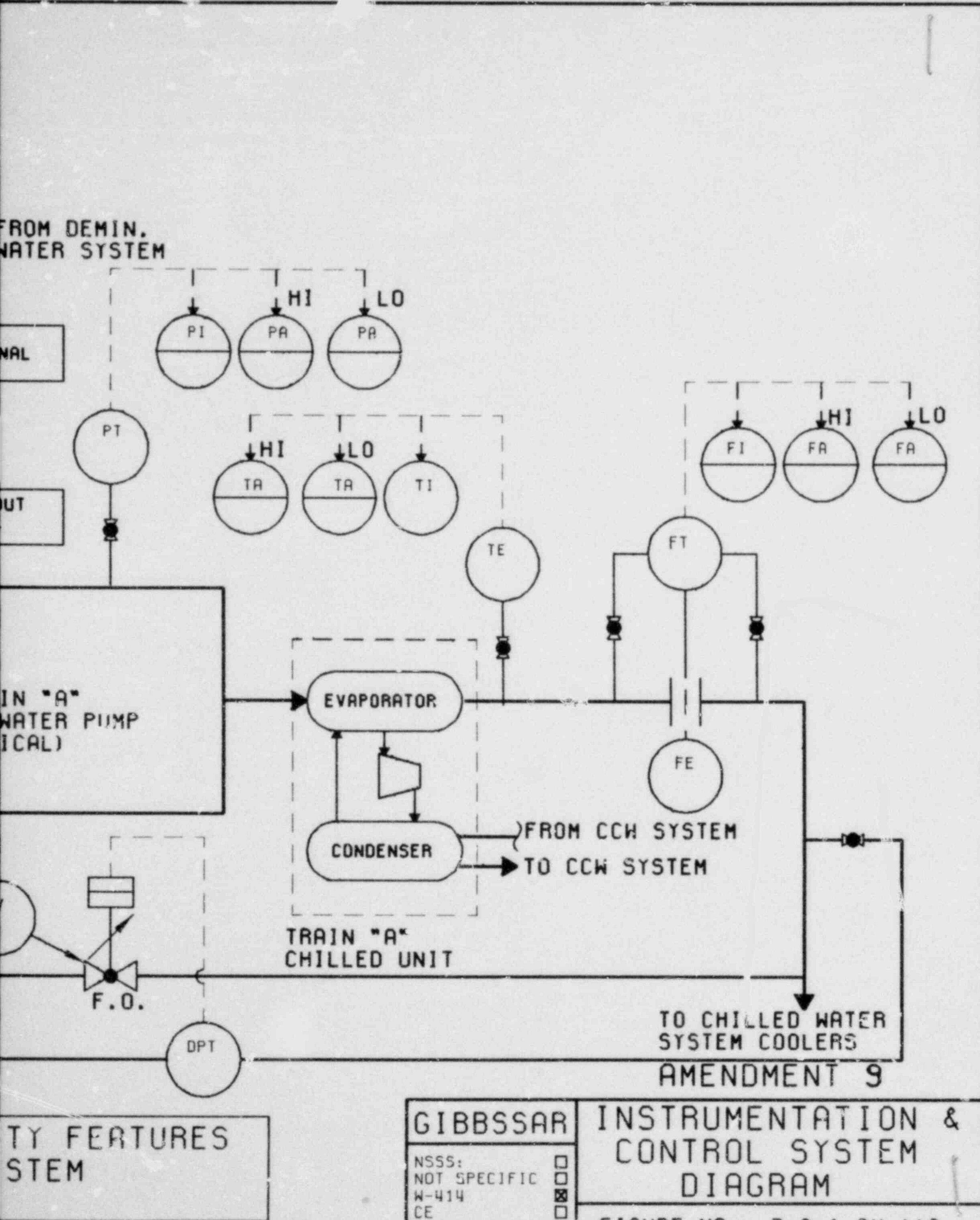
NSSS:
NOT SPECIFIC ☐
W-414 ☒
CE ☐
B & W ☐

INSTRUMENTATION & CONTROL SYSTEM LOGIC DIAGRAM

FIGURE NO. 7.3-1 SH.11



VENTILATION SAFE
CHILLED WATER SY
(TRAIN B SIMILAR)

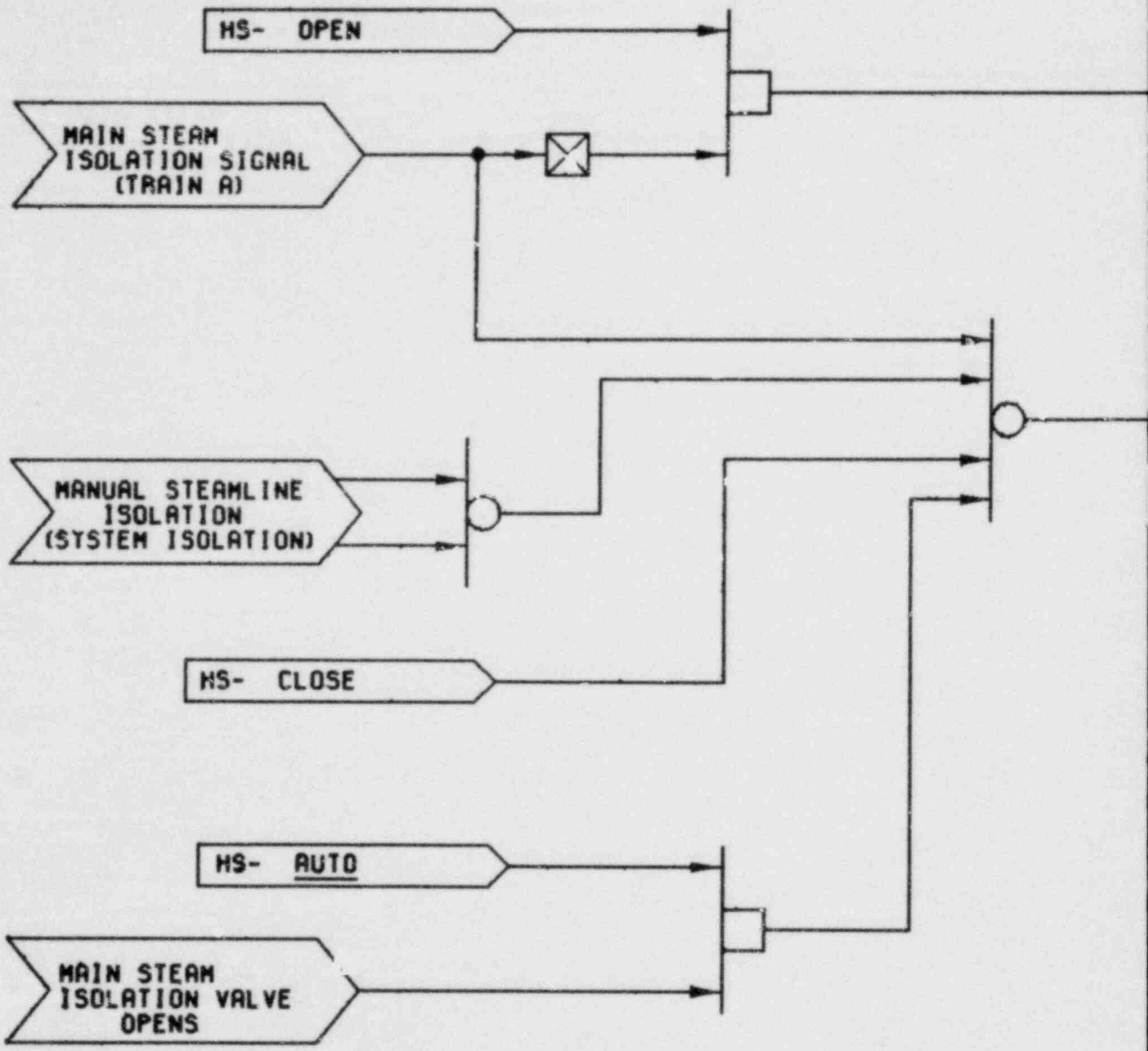


GIBBSSAR

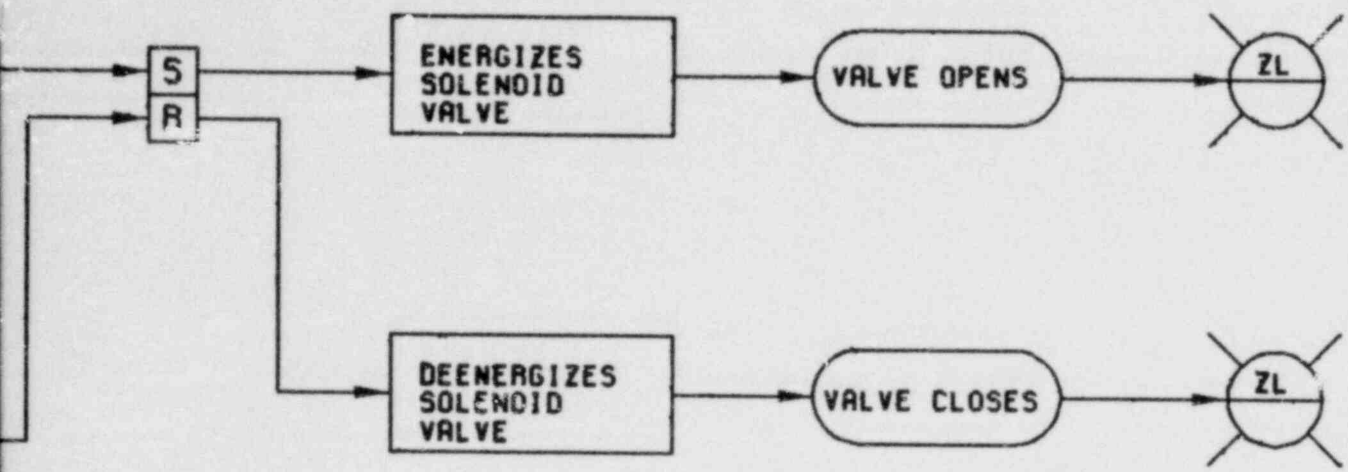
NSSS:
NOT SPECIFIC ☐
W-414 ☒
CE ☐
B & W ☐

INSTRUMENTATION & CONTROL SYSTEM DIAGRAM

FIGURE NO. 7.3-1 SH.11A



MAIN STEAM ISOLATION BYP
CONTROL LOGIC



NOTE:

1. TRAIN A LOGIC SHOWN, TRAIN B LOGIC SIMILAR.

2. SIMULTANEOUS OPERATION OF BOTH HANDSWITCHES IS REQUIRED TO OPEN EACH MAIN STEAM ISOLATION BYPASS VALVE.

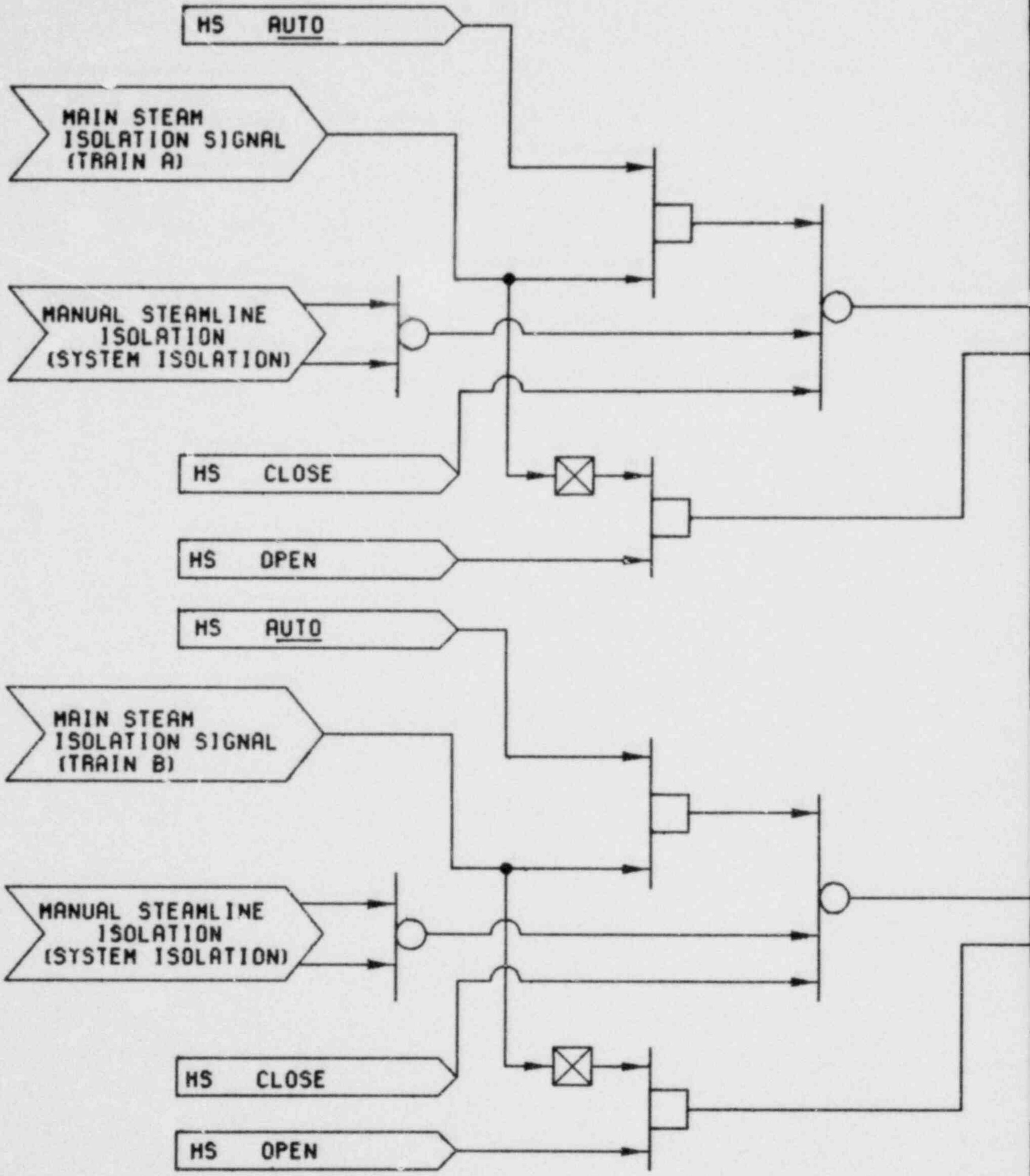
OPERATOR MANUAL CONTROLS

HS CLOSE → AUTO ← OPEN

AMENDMENT 9

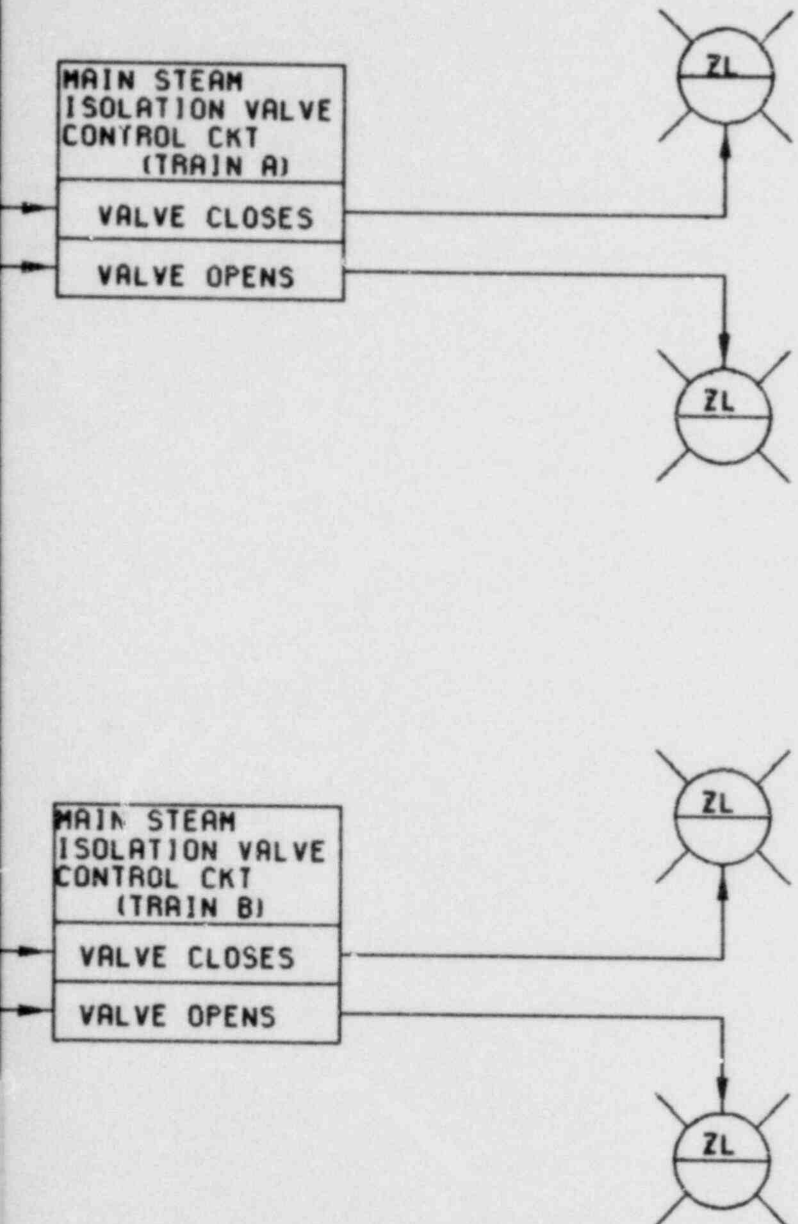
ASS VALVE

GIBBSSAR	INSTRUMENTATION & CONTROL SYSTEM LOGIC DIAGRAM
NSSS: ☐ NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.12



MAIN STEAM ISOLATION VALVE C

TYPICAL FOR ONE OF FOUR MAIN STEAM IS



NOTE:

1. SIMULTANEOUS OPERATION OF BOTH HAND SWITCHES IS REQUIRED TO OPEN EACH MAIN STEAM ISOLATION VALVE.

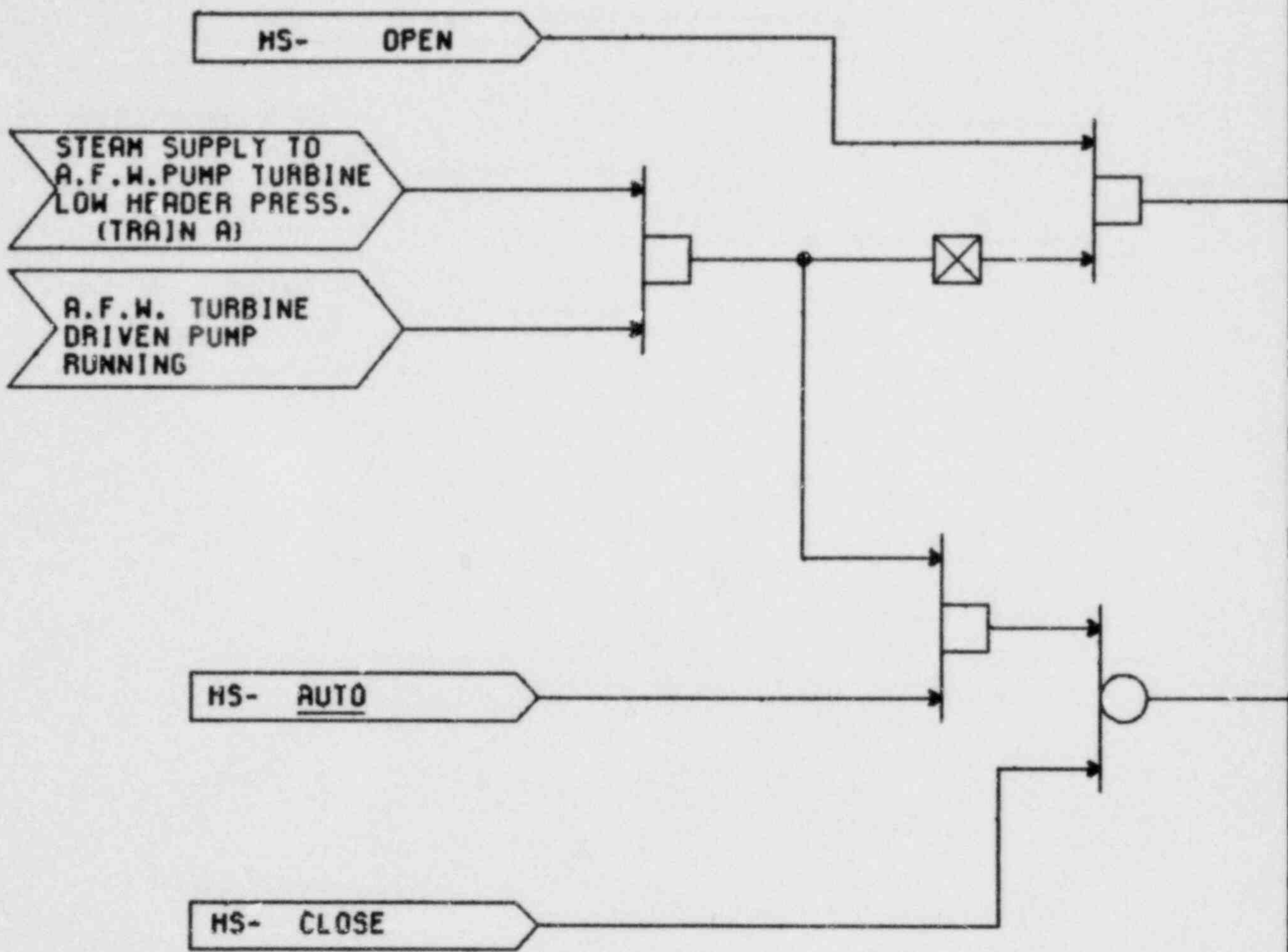
OPERATOR MANUAL CONTROLS

HS CLOSE → AUTO ← OPEN
HS CLOSE → AUTO ← OPEN

ONTROL LOGIC
OLATION VALVES.

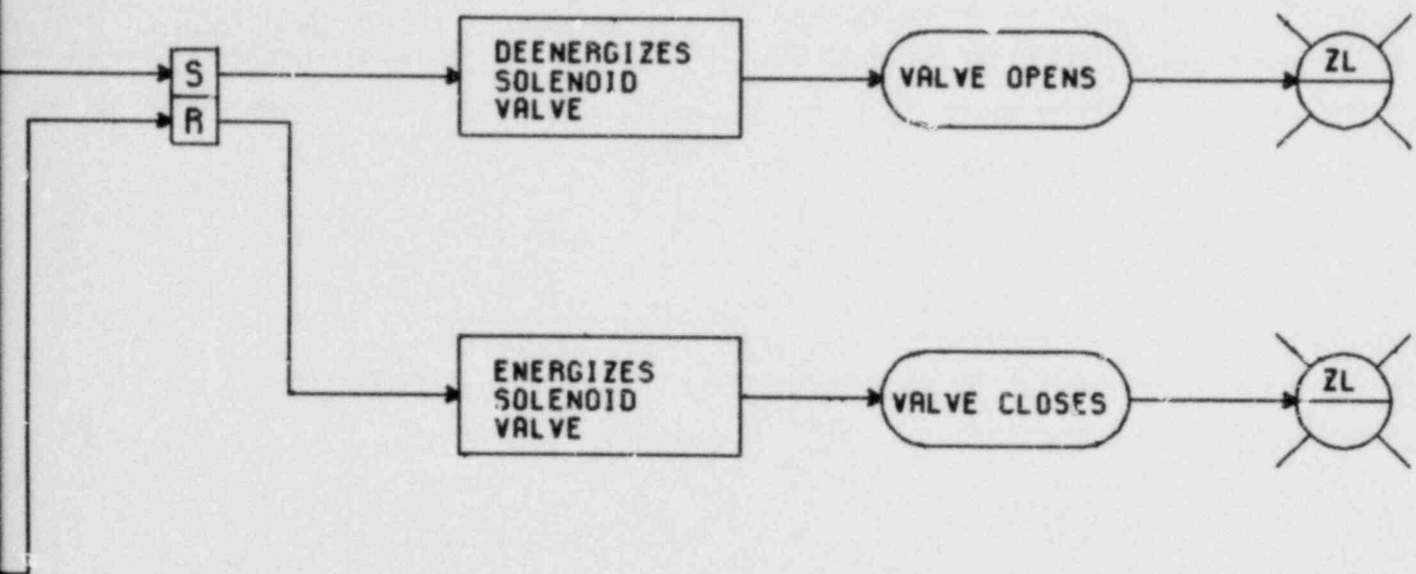
AMENDMENT 9

GIBBSSAR	INSTRUMENTATION & CONTROL SYSTEM LOGIC DIAGRAM
NSSS: ☐ NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.13



AUXILIARY FEEDWATER TURBINE DRIV
STEAM SUPPLY VALVE

(TRAIN B SIMILAR)



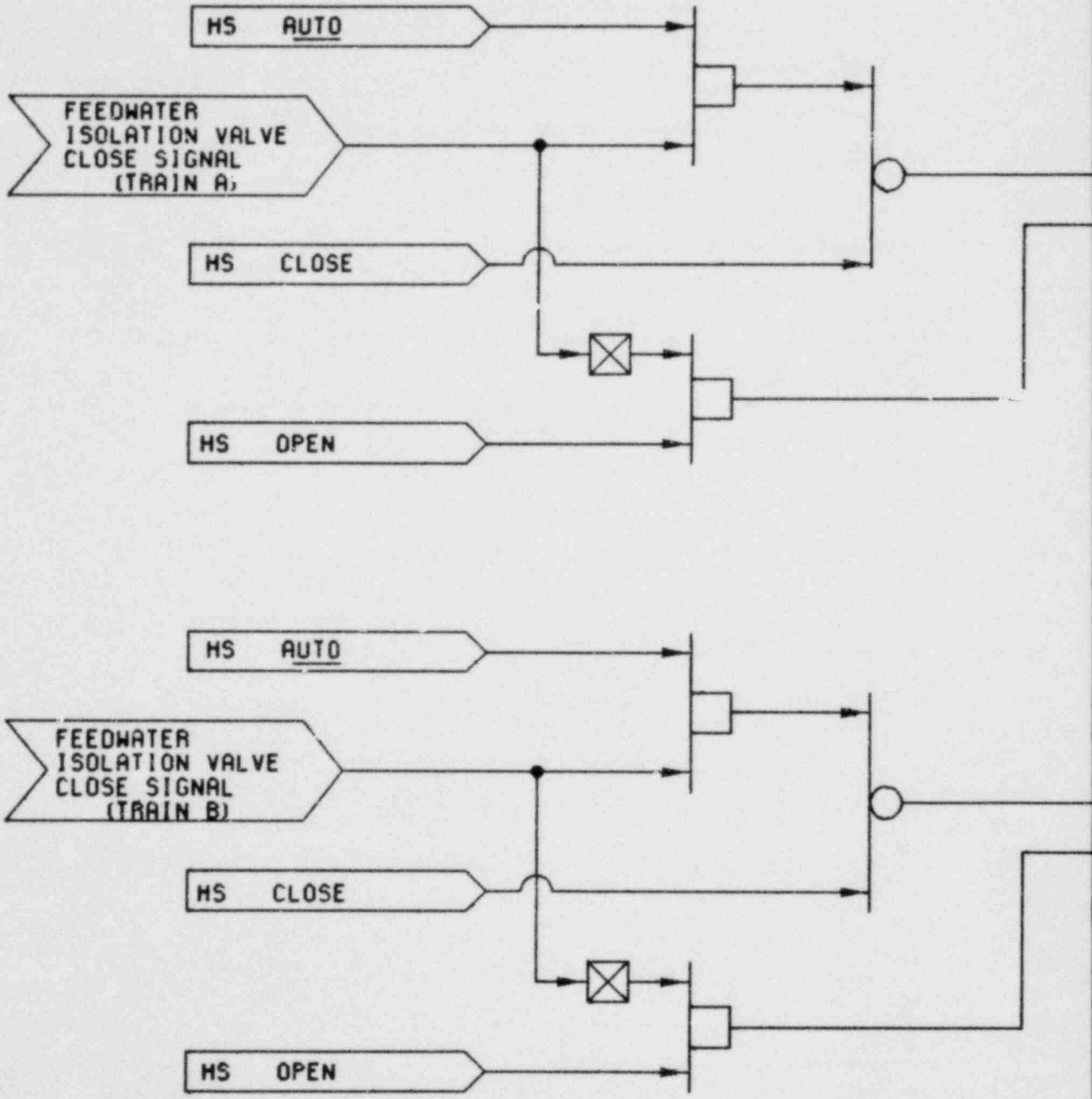
OPERATOR MANUAL CONTROLS

HS- CLOSE →AUTO ←OPEN

EN PUMP

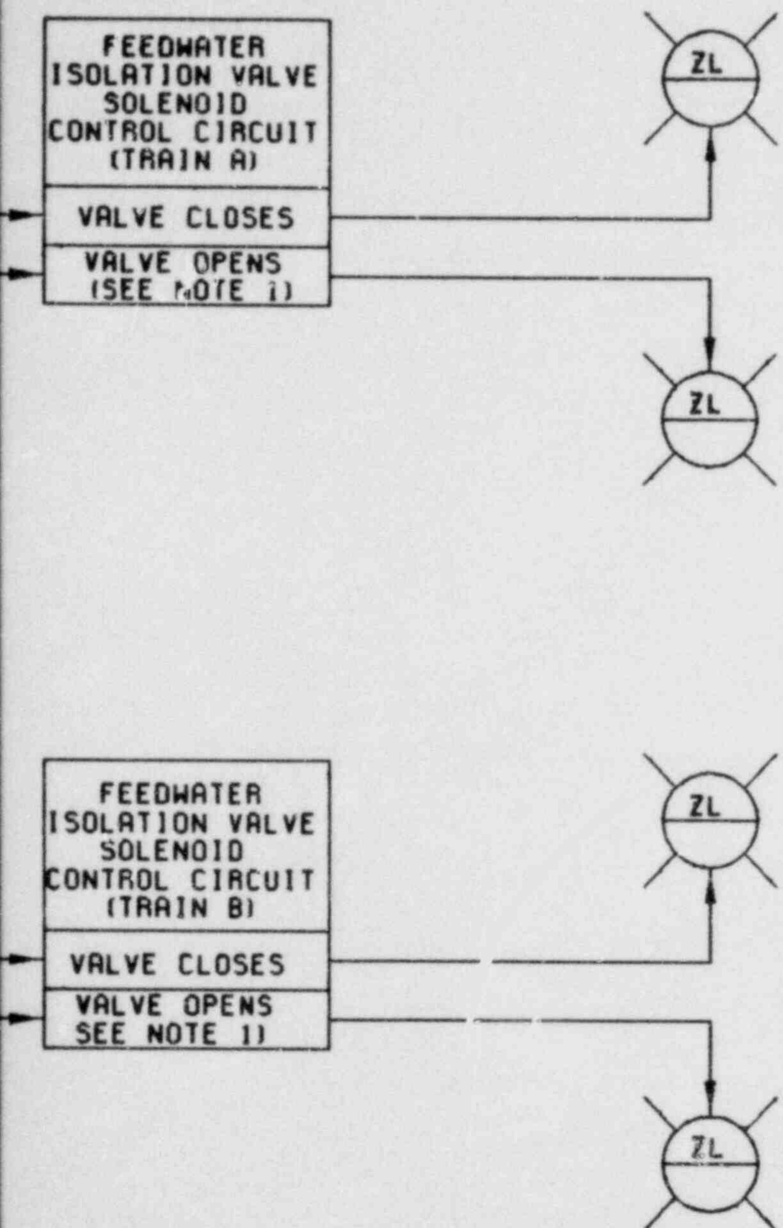
AMENDMENT 9

GIBBSSAR	INSTRUMENTATION & CONTROL SYSTEM LOGIC DIAGRAM
NSSS: ☐ NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.13A



FEEDWATER ISOLATION VALVE C

TYPICAL FOR ONE OF FOUR FEEDWATER ISO



NOTE:

1. SIMULTANEOUS OPERATION OF BOTH HAND SWITCHES IS REQUIRED TO OPEN EACH FEEDWATER ISOLATION VALVE.

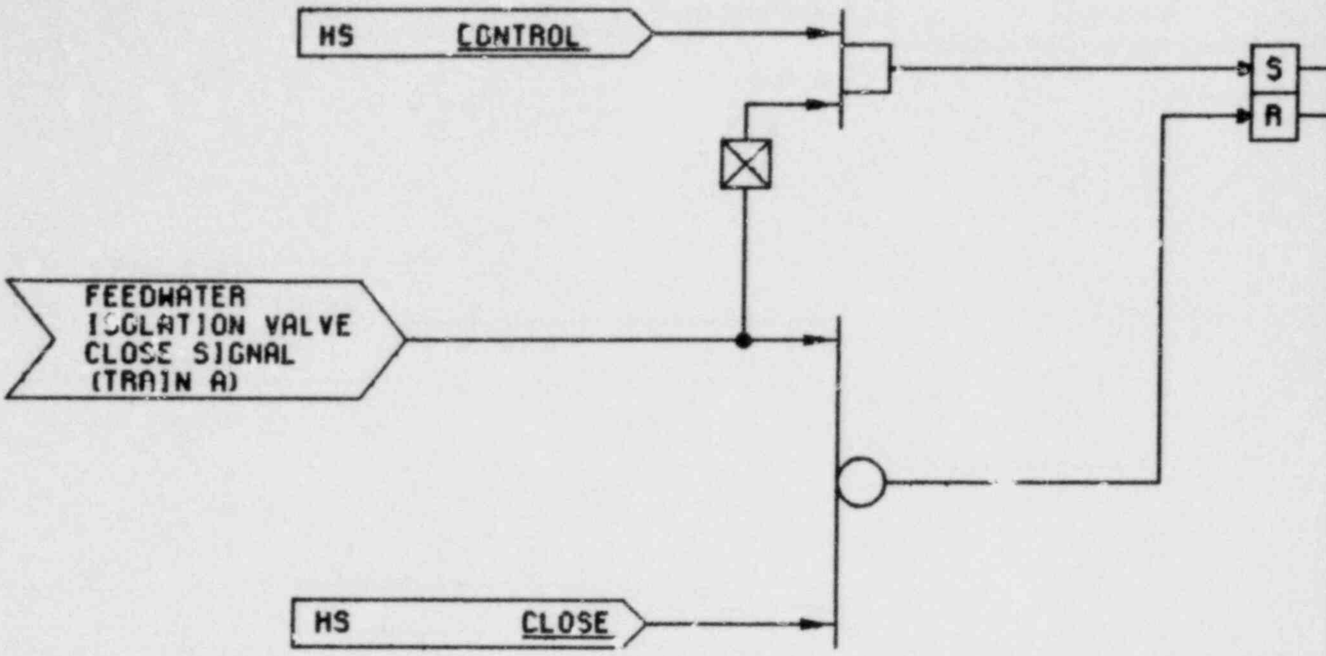
OPERATOR MANUAL CONTROLS

HS CLOSE → AUTO ← OPEN
HS CLOSE → AUTO ← OPEN

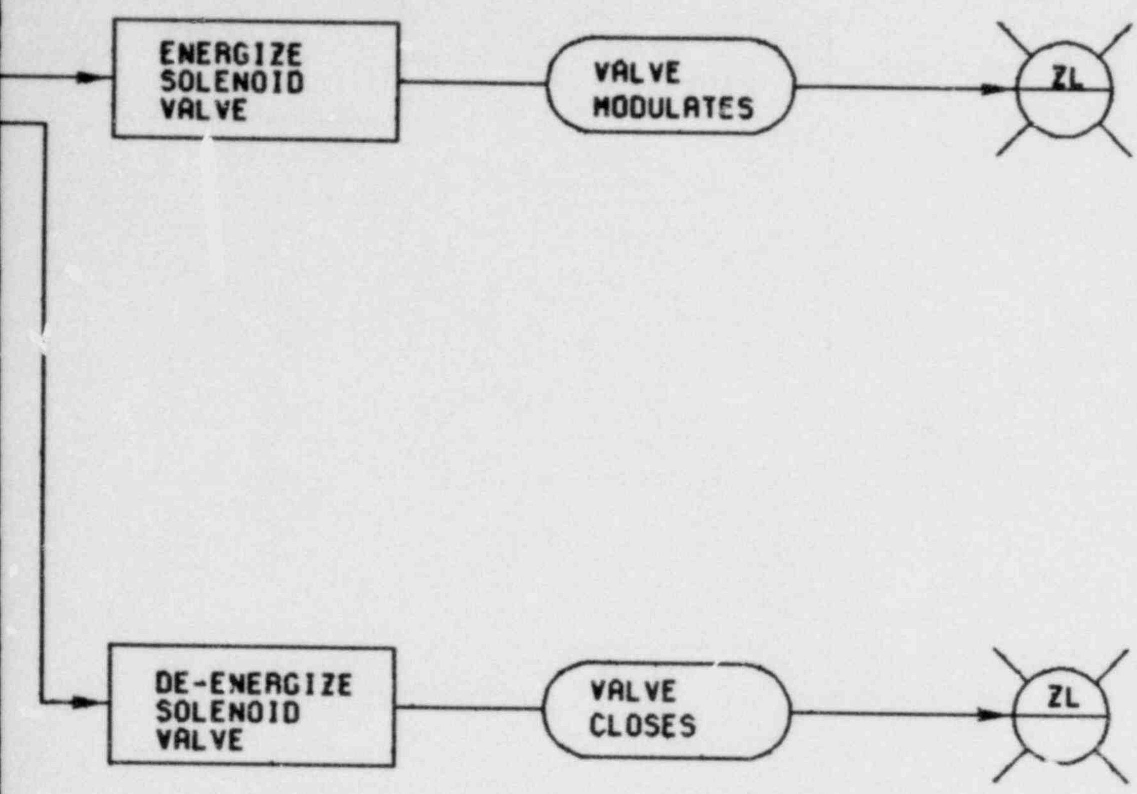
AMENDMENT 9

ONTROL LOGIC
LATION VALVES.

GIBBSSAR	INSTRUMENTATION & CONTROL SYSTEM LOGIC DIAGRAM
NSSS: ☐ NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.14



FEEDWATE
VALVE CO



OPERATOR MANUAL CONTROLS

HS- CLOSE - CONTROL

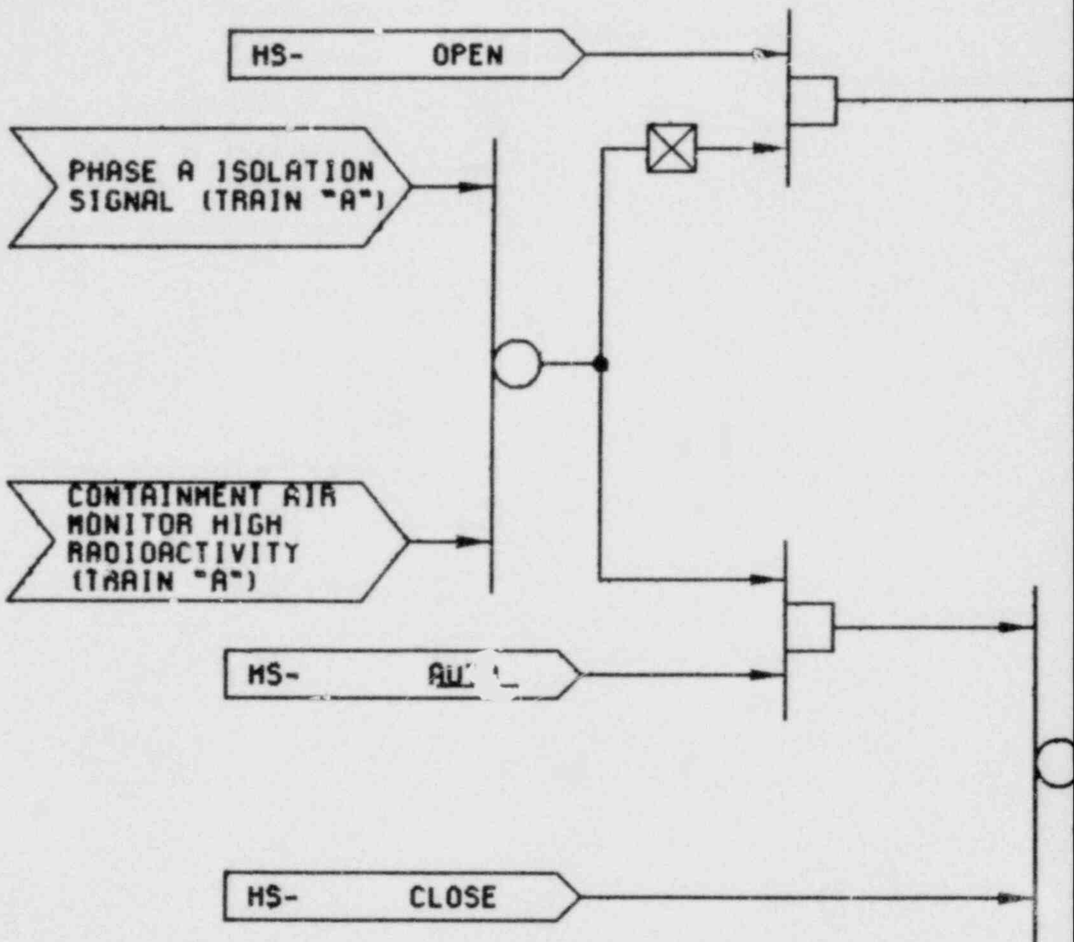
NOTES:

1. FEEDWATER ISOLATION LOGIC DUPLICATED WITHIN EACH TRAIN.
2. CONTROL LOGIC SHOWN FOR TRAIN A. TRAIN B LOGIC SIMILAR.
3. SIMULTANEOUS OPERATION OF BOTH HANDSWITCHES IS REQUIRED TO OPEN EACH FEEDWATER BYPASS CONTROL VALVE.

AMENDMENT-9

ER BYPASS CONTROL
ONTROL LOGIC

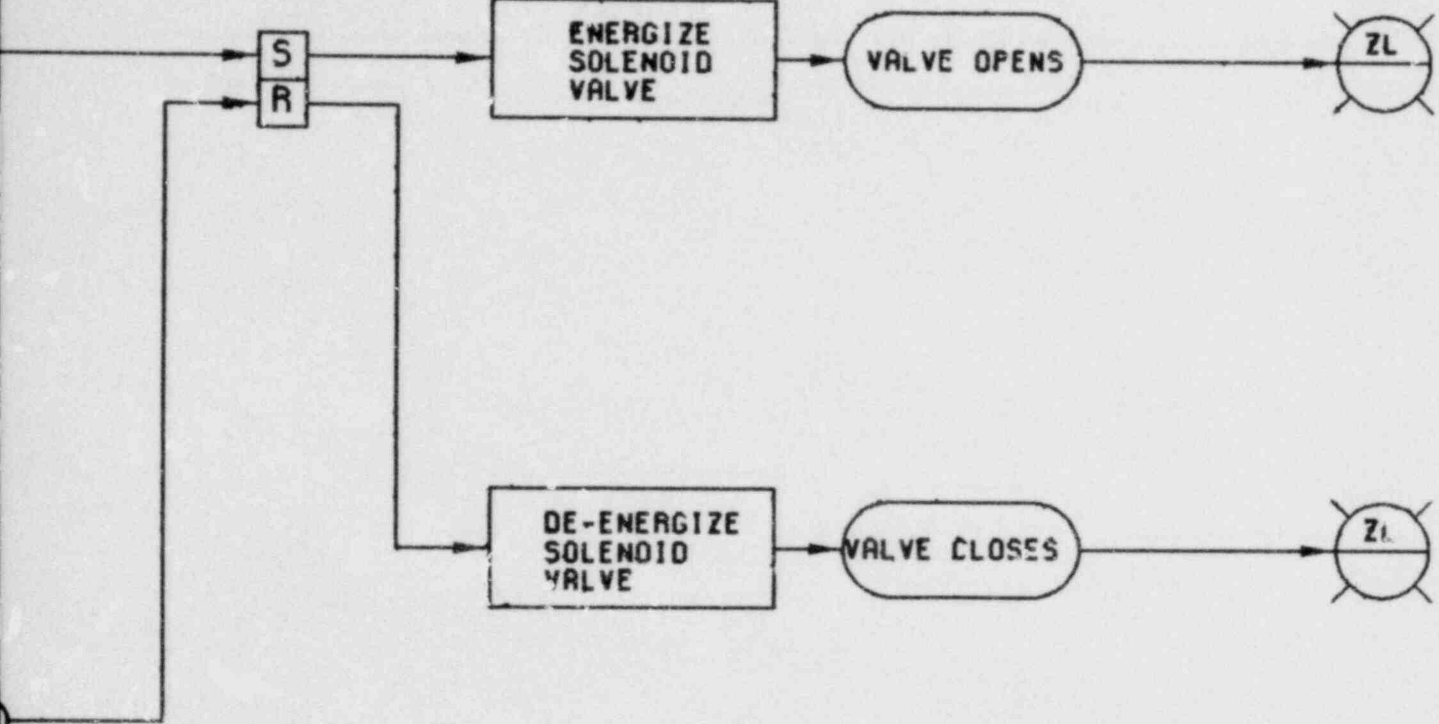
GIBBSSAR	INSTRUMENTATION & CONTROL SYSTEM LOGIC DIAGRAM
NSSS: ☐ NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.15



NOTES:

1. CONTROL LOGIC SHOWN FOR TRAIN "A" AIR OPERATED VALVE. TRAIN "B" AIR OPERATED VALVE SIMILAR.
2. CONTROL LOGIC IS TYPICAL OF AIR OPERATED ISOLATION VALVE THAT CLOSES ON PHASE A ISOLATION SIGNAL OR CONTAINMENT HIGH RADIOACTIVITY.

CONTAINMENT ISOLA

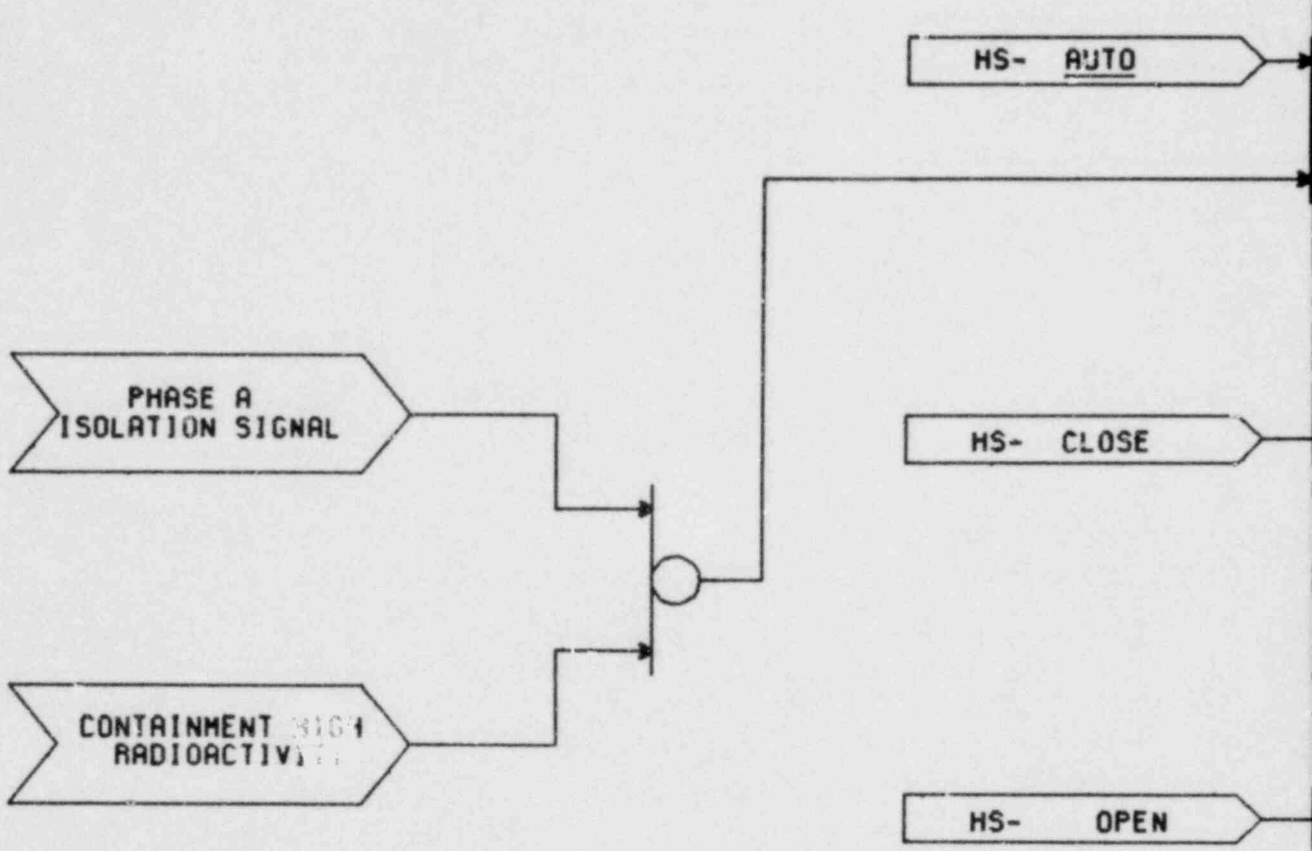


OPERATOR MANUAL CONTROLS

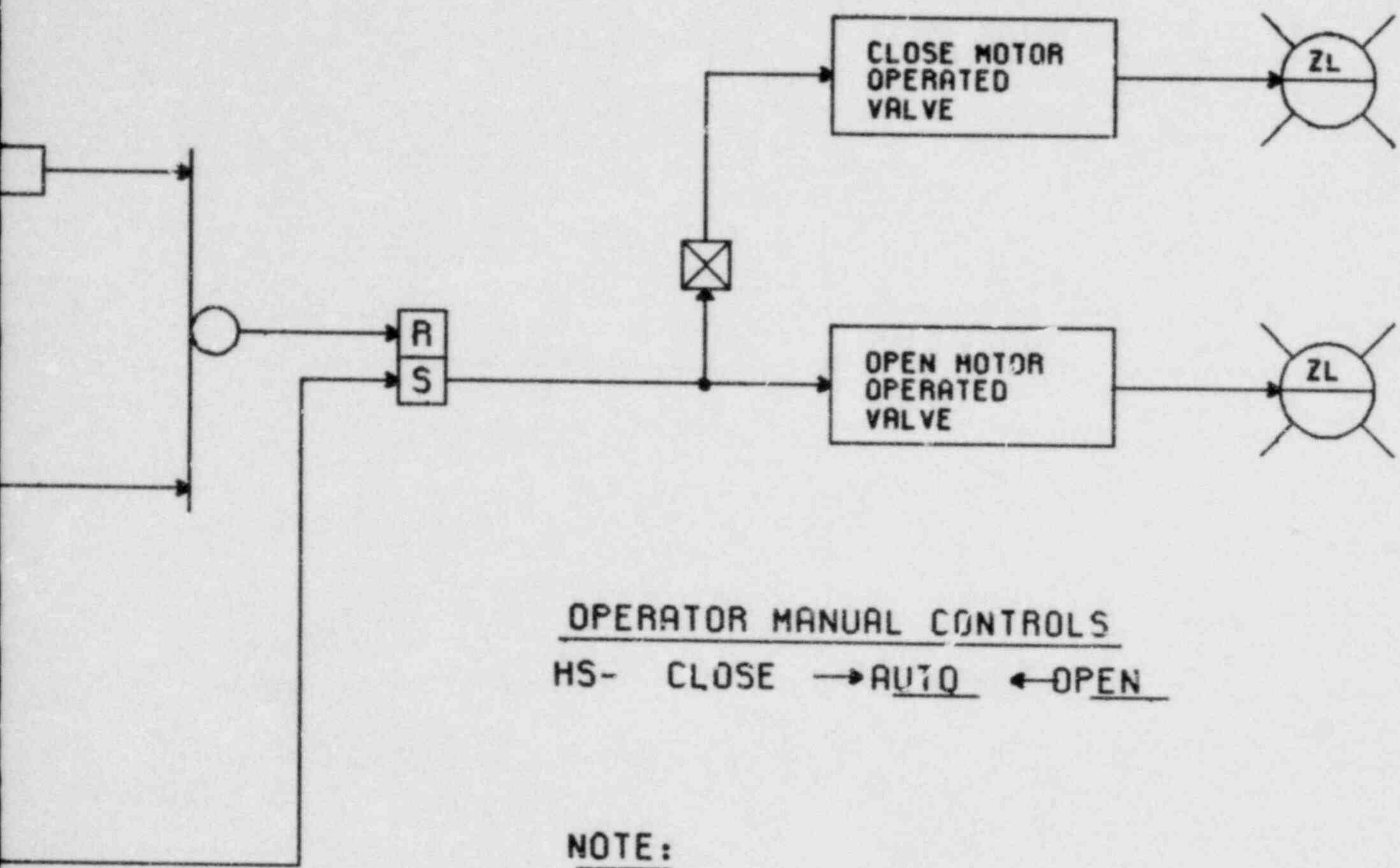
HS- CLOSE → AUTO ← OPEN

AMENDMENT 9

GIBBSSAR	INSTRUMENTATION AND CONTROL SYSTEM LOGIC DIAGRAM	...TION SYSTEM
NSSS: NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.16	



CONTAINMENT ISOLATION



OPERATOR MANUAL CONTROLS

HS- CLOSE → AUTO ← OPEN

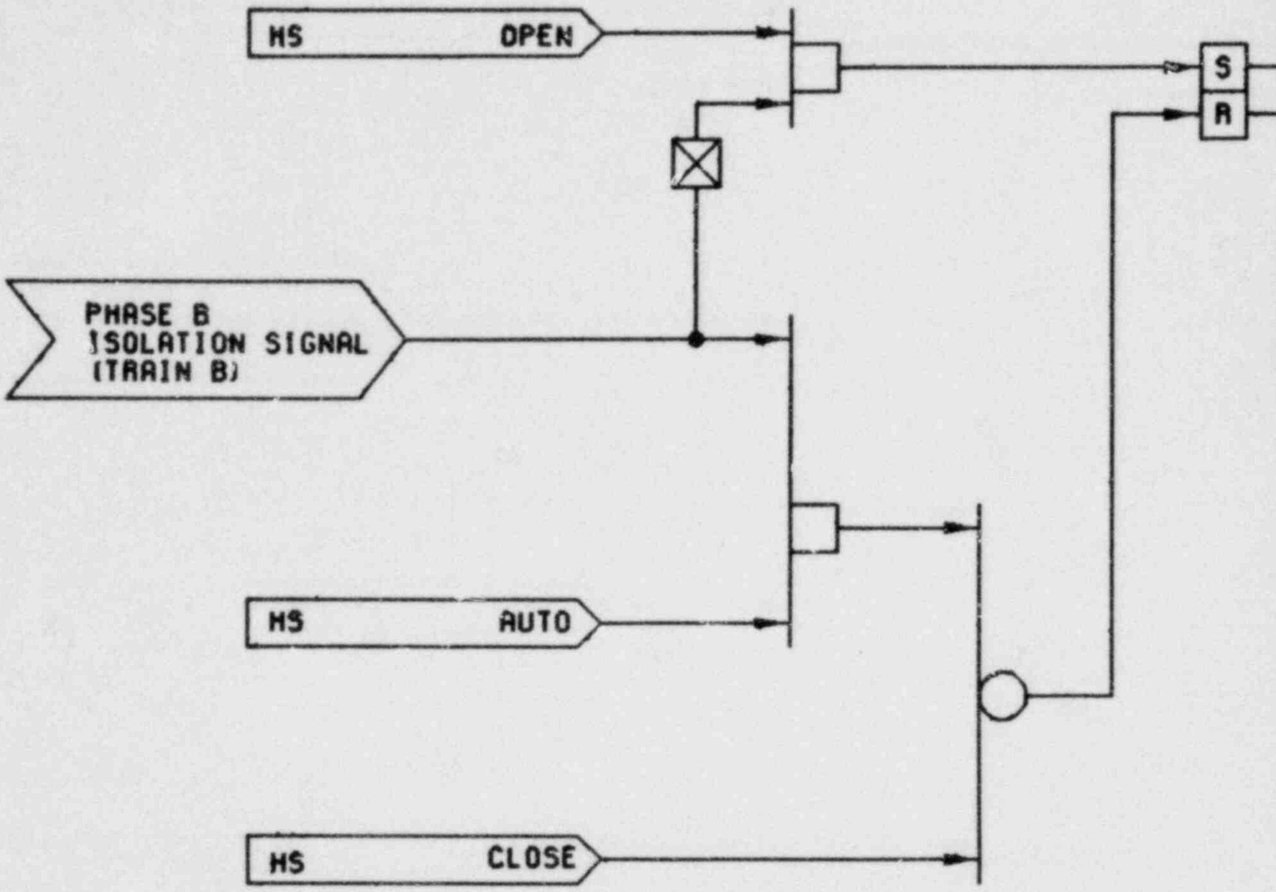
NOTE:

1. CONTROL LOGIC SHOWN FOR TRAIN A MOTOR OPERATED VALVE; TRAIN B MOTOR OPERATED VALVE SIMILAR.
2. CONTROL LOGIC IS TYPICAL OF MOTOR OPERATED ISOLATION VALVE THAT CLOSES ON PHASE A ISOLATION SIGNAL OR CONTAINMENT HIGH RADIOACTIVITY.

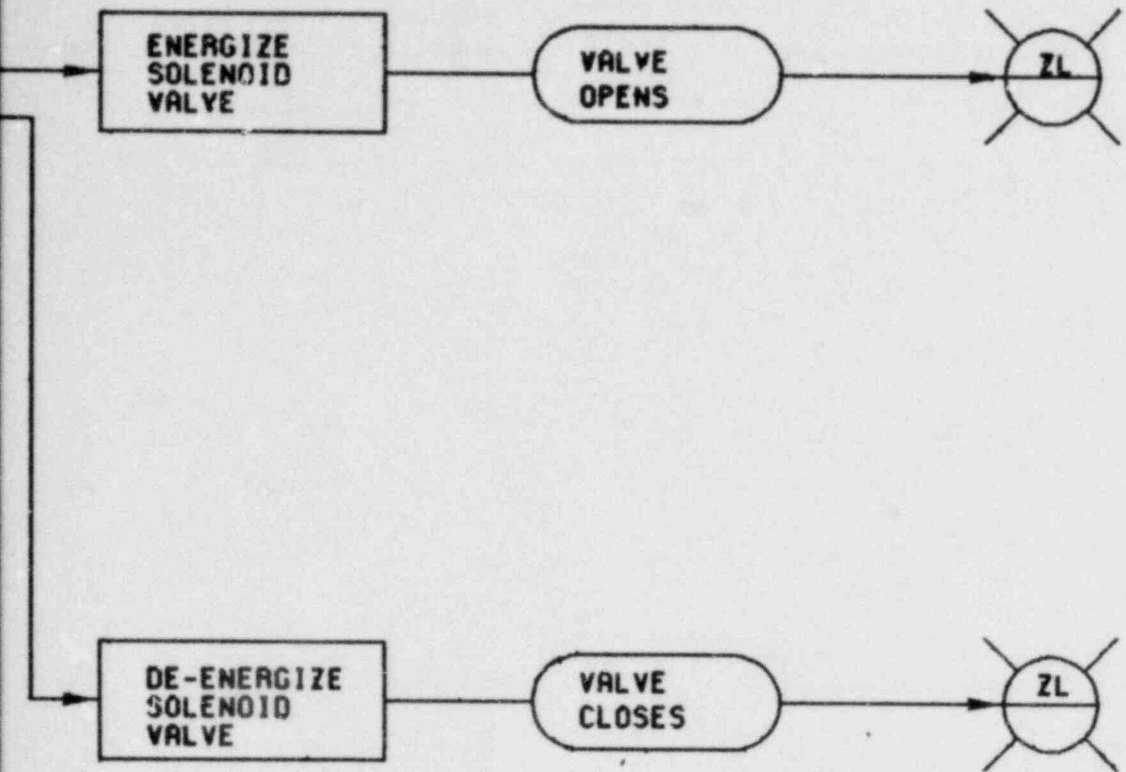
N SYSTEM

AMENDMENT 9

GIBBSSAR	INSTRUMENTATION & CONTROL SYSTEM LOGIC DIAGRAM
NSSS: ☐ NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.16A



CONTAINMENT



OPERATOR MANUAL CONTROLS

HS- OPEN ——► AUTO ◄—— CLOSE

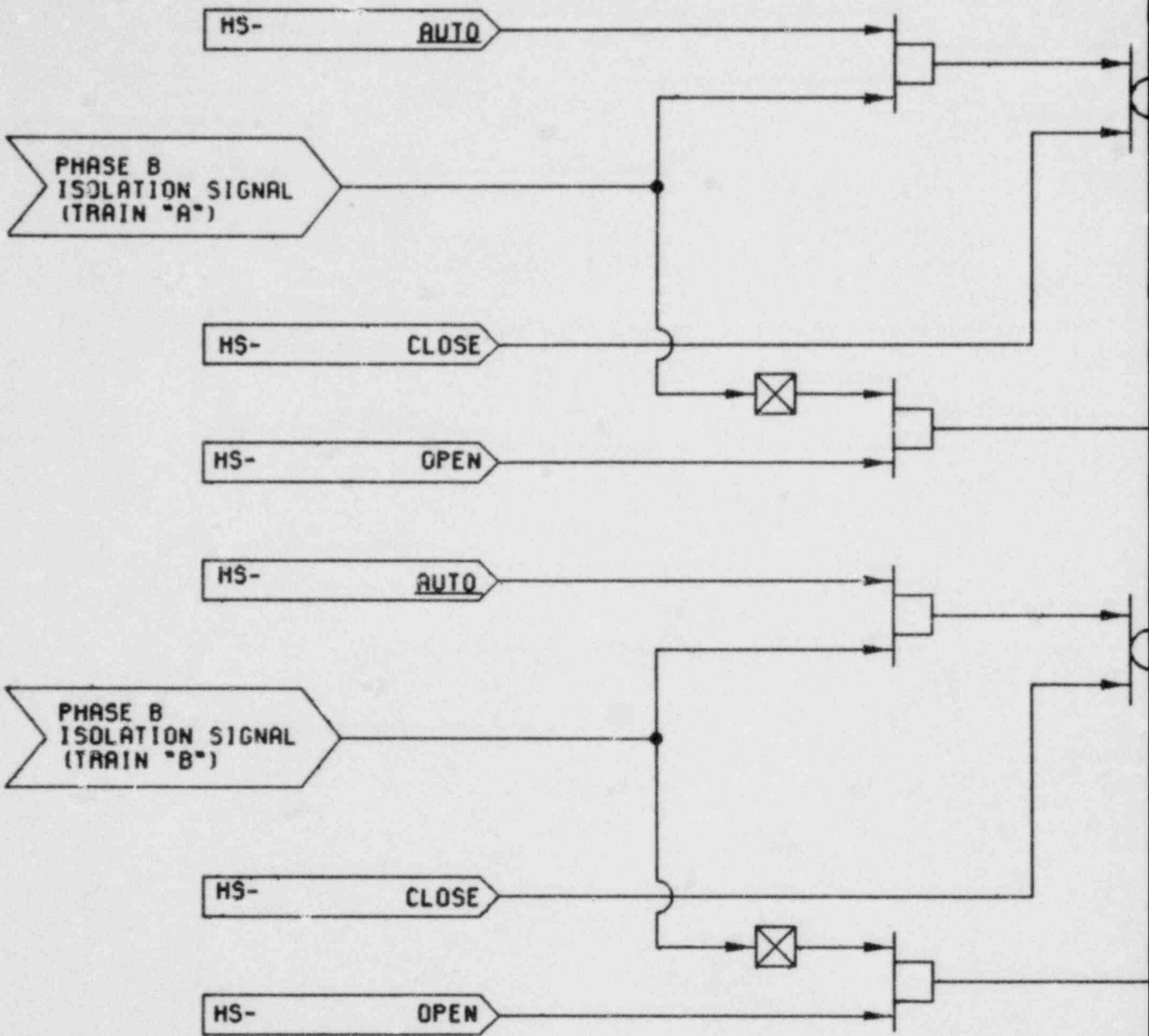
NOTE

1. CONTROL LOGIC SHOWN IS TYPICAL OF AIR OPERATED ISOLATION VALVE THAT CLOSES ON PHASE B ISOLATION SIGNAL.

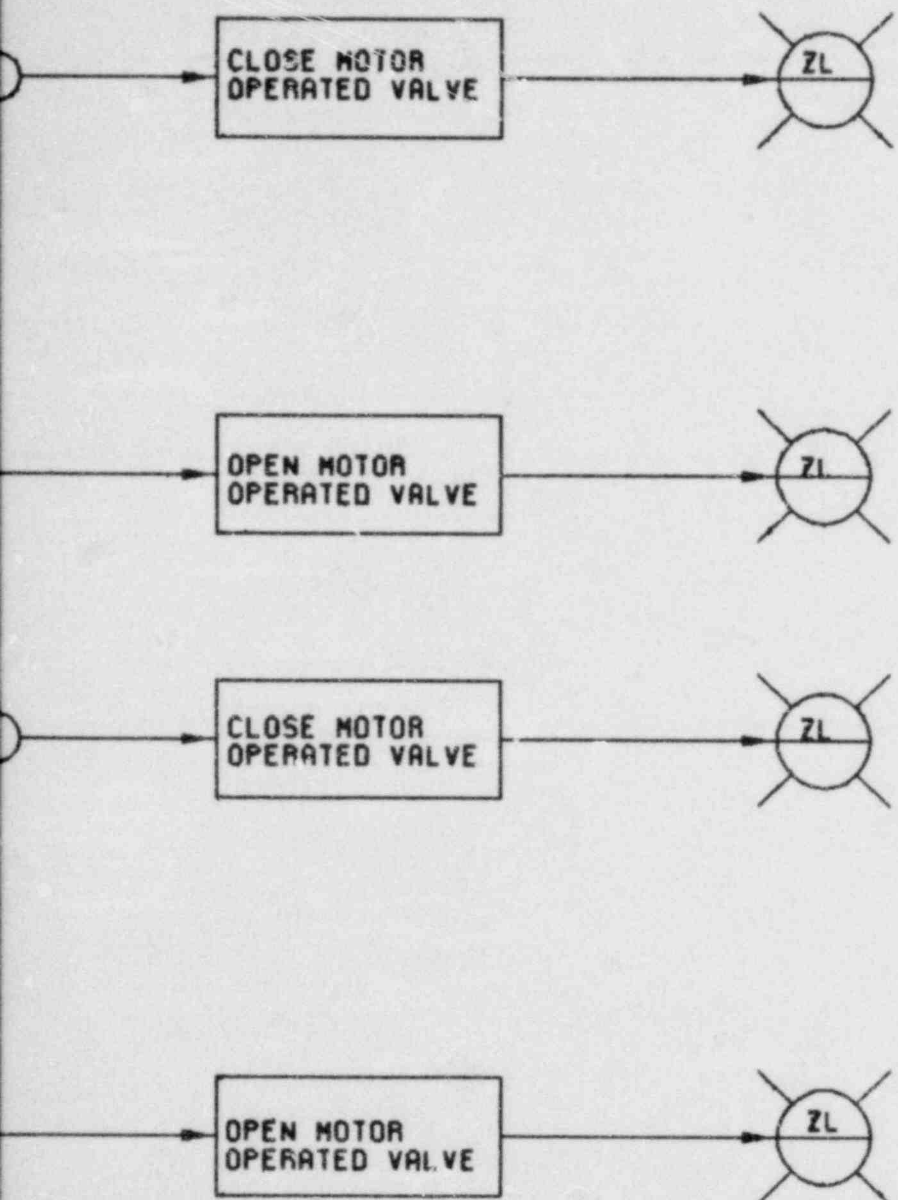
AMENDMENT-9

ISOLATION SYSTEM

GIBBSSAR	INSTRUMENTATION & CONTROL SYSTEM LOGIC DIAGRAM
NSSS: ☐ NOT SPECIFIC ☐ W-414 ☒ CE ☐ B & W ☐	FIGURE NO. 7.3-1 SH.16B



CONTAINMENT ISOLAT



NOTE:

1. CONTROL LOGIC SHOWN IS TYPICAL OF MOTOR OPERATED ISOLATION VALVES THAT CLOSE ON PHASE "B" ISOLATION SIGNAL

OPERATOR MANUAL CONTROLS

HS- CLOSE ⟶ AUTO ⟵ OPEN

HS- CLOSE ⟶ AUTO ⟵ OPEN

AMENDMENT-9

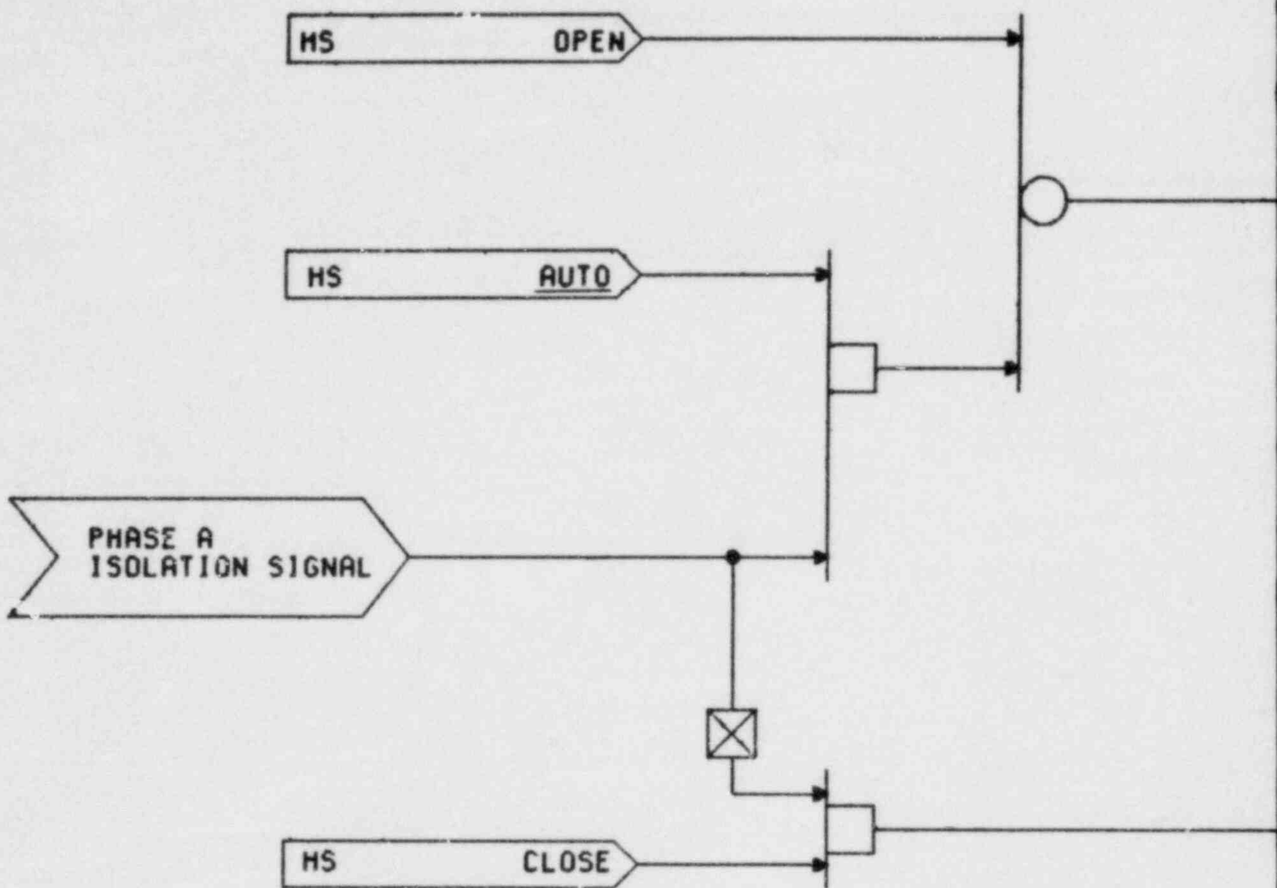
ION SYSTEM

GIBBSSAR

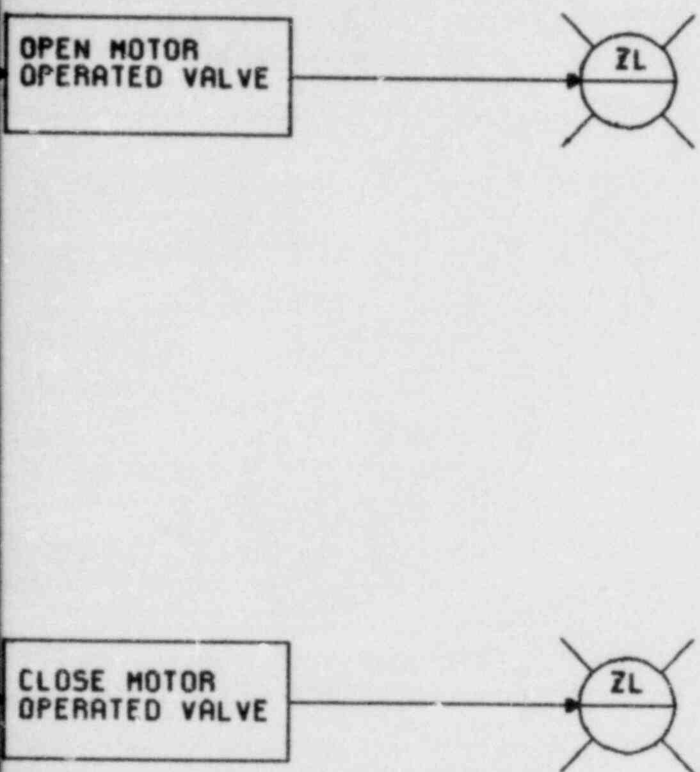
NSSS: ☐
NOT SPECIFIC ☐
W-414 ☒
CE ☐
B & W ☐

INSTRUMENTATION & CONTROL SYSTEM LOGIC DIAGRAM

FIGURE NO. 7.3-1 SH.16C



COMPONENT COOLI
RESIDUAL HEAT REMOVAL
OUTLET VALVE CONTROL L



OPERATOR MANUAL CONTROLS

HS OPEN ⟶ AUTO ⟵ CLOSE

NOTE

1. CONTROL LOGIC SHOWN FOR TRAIN A MOTOR OPERATED VALVE.
   TRAIN B MOTOR OPERATED VALVE SIMILAR.
2. CONTROL LOGIC IS TYPICAL OF MOTOR OPERATED VALVE THAT OPENS ON PHASE A ISOLATION SIGNAL.

AMENDMENT-9

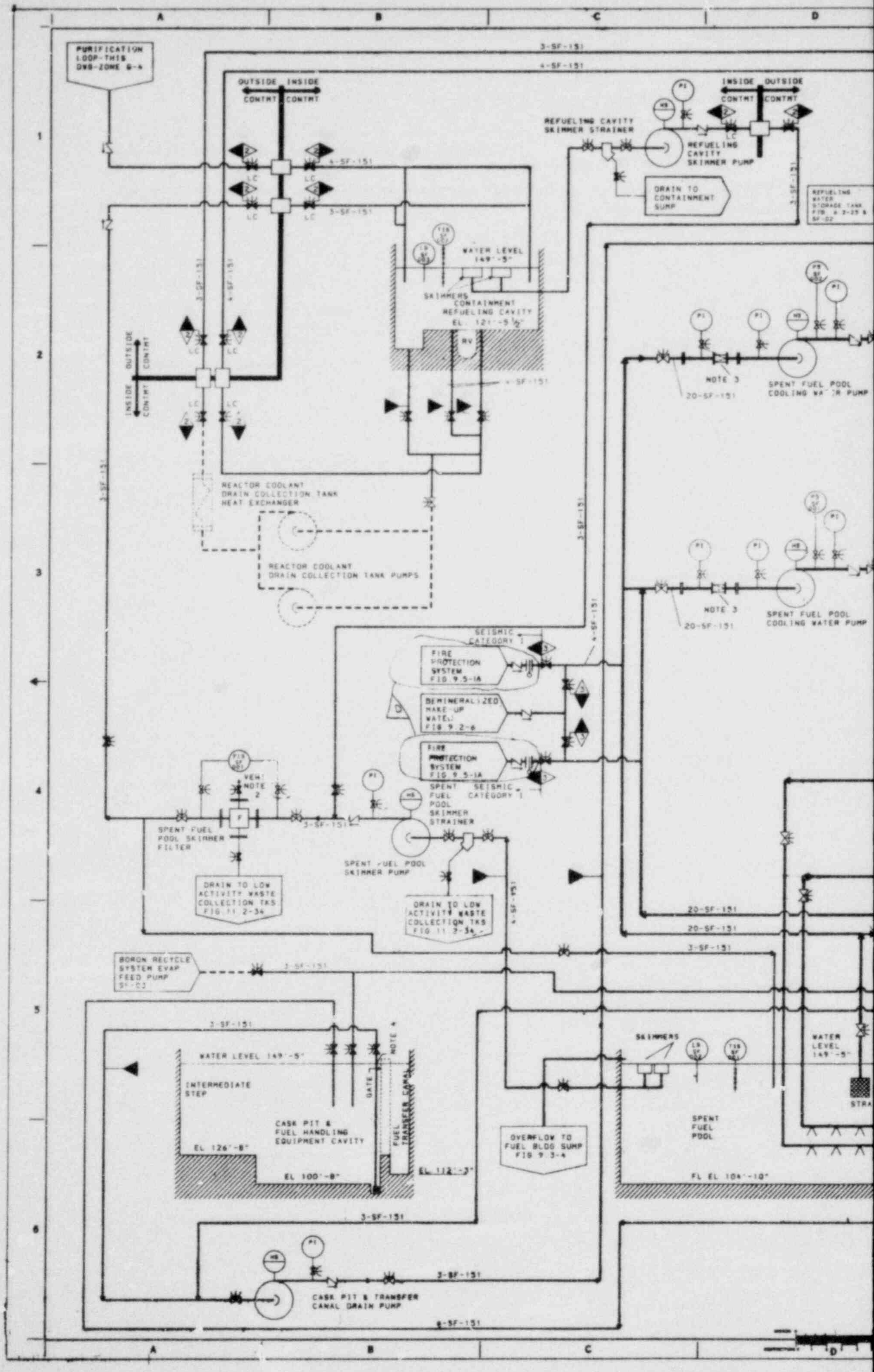
NG WATER SYSTEM
HEAT EXCHANGER
OGIC

GIBBSSAR

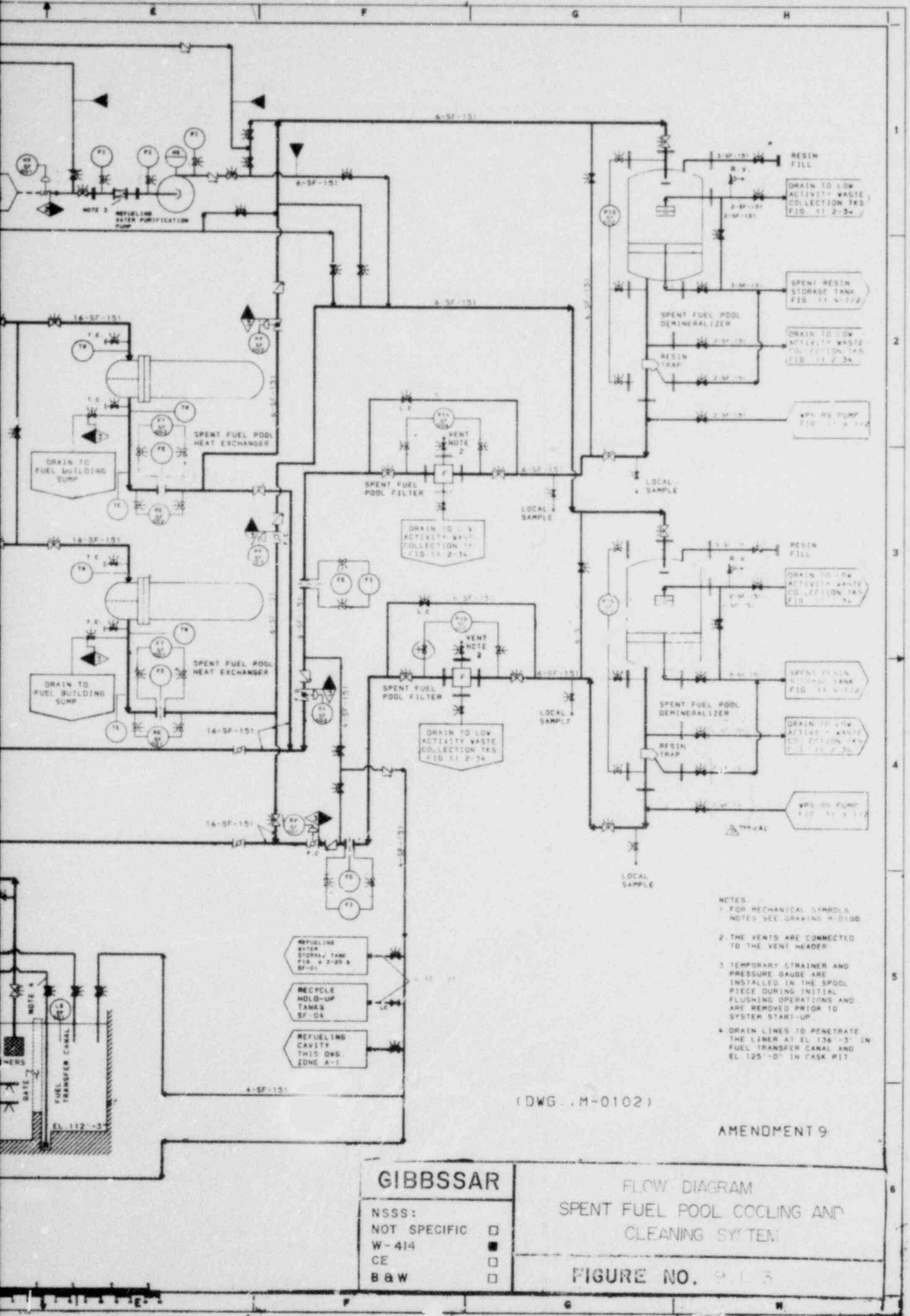
NSSS:
- NOT SPECIFIC ☐
- W-414 ☒
- CE ☐
- B & W ☐

INSTRUMENTATION & CONTROL SYSTEM LOGIC DIAGRAM

FIGURE NO. 7.3-1 SH. 16D



A
B
C
D
1
2
3
4
5
6
PURIFICATION LOOP-THIS DWG-ZONE B-4
3-SF-151
4-SF-151
OUTSIDE CONTMT
INSIDE CONTMT
REFUELING CAVITY SKIMMER STRAINER
REFUELING CAVITY SKIMMER PUMP
DRAIN TO CONTAINMENT SUMP
LC
WATER LEVEL 149'-5"
SKIMMERS
CONTAINMENT REFUELING CAVITY
RV
REACTOR COOLANT DRAIN COLLECTION TANK HEAT EXCHANGER
REACTOR COOLANT DRAIN COLLECTION TANK PUMPS
NOTE 3
20-SF-151
SPENT FUEL POOL COOLING WATER PUMP
SEISMIC CATEGORY I
FIRE PROTECTION SYSTEM FIG 9.5-1A
DEMINERALIZED MAKE-UP WATER FIG 9.2-6
SPENT FUEL POOL SKIMMER STRAINER
SPENT FUEL POOL SKIMMER FILTER
VENT NOTE 2
SPENT FUEL POOL SKIMMER PUMP
DRAIN TO LOW ACTIVITY WASTE COLLECTION TKS FIG 11.2-34
BORON RECYCLE SYSTEM EVAP FEED PUMP
WATER LEVEL 149'-5"
INTERMEDIATE STEP
CASK PIT & FUEL HANDLING EQUIPMENT CAVITY
EL 126'-8"
EL 100'-8"
GATE
NOTE 4
FUEL TRANSFER CANAL
EL 112'-3"
OVERFLOW TO FUEL BLDG SUMP FIG 9.3-4
SKIMMERS
SPENT FUEL POOL
FL EL 104'-10"
WATER LEVEL 149'-5"
CASK PIT & TRANSFER CANAL DRAIN PUMP

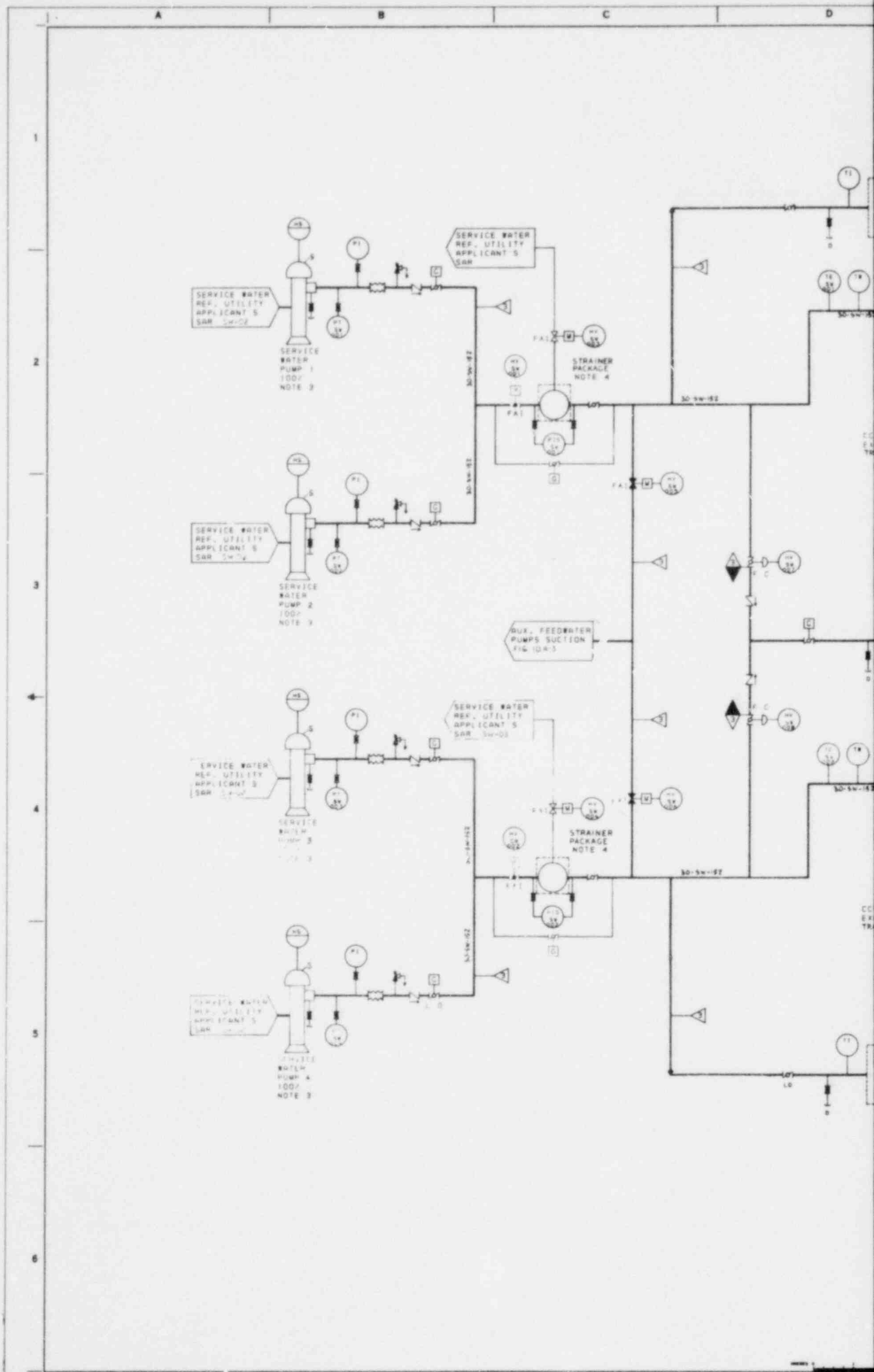


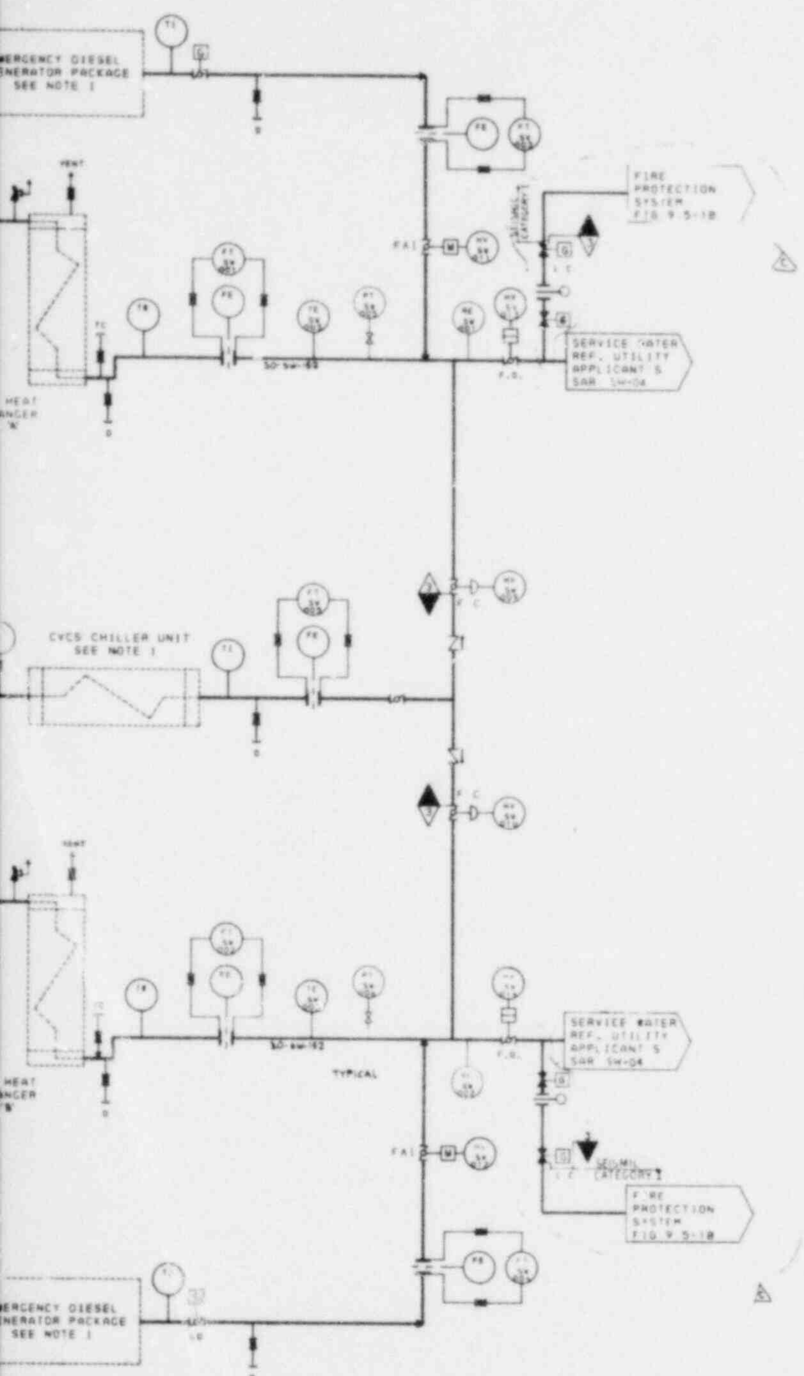
GIBBSSAR

NSSS:
NOT SPECIFIC ☐
W-414 ■
CE ☐
B&W ☐

FLOW DIAGRAM
SPENT FUEL POOL COOLING AND CLEANING SYSTEM

FIGURE NO. 9.1-3


SERVICE WATER REF. UTILITY APPLICANT'S SAR
SERVICE WATER REF. UTILITY APPLICANT'S SAR SW-02
SERVICE WATER PUMP 1 100% NOTE 3
STRAINER PACKAGE NOTE 4
SERVICE WATER PUMP 2 100% NOTE 3
AUX. FEEDWATER PUMPS SUCTION
STRAINER PACKAGE NOTE 4
SERVICE WATER PUMP 4 100% NOTE 3
30-SW-152



NOTES

1. THE EMERGENCY DIESEL GENERATORS AND CVCS CHILLER UNIT WILL BE COOLED BY THE SERVICE WATER SYSTEM. ON THOSE SITES WHERE WATER QUALITY IS UNACCEPTABLE [illegible] CCW WILL BE USED INSTEAD.

2. FLOW DIAGRAM IS BASED ON A WESTINGHOUSE NSSS.

3. VERTICAL [illegible] ACTUAL TYPE OF PUMP IS SITE RELATED AND WILL DEPEND ON THE ULTIMATE HEAT SINK.

4. THE USE OF STRAINERS IS SITE RELATED AND WILL DEPEND ON THE ULTIMATE HEAT SINK.

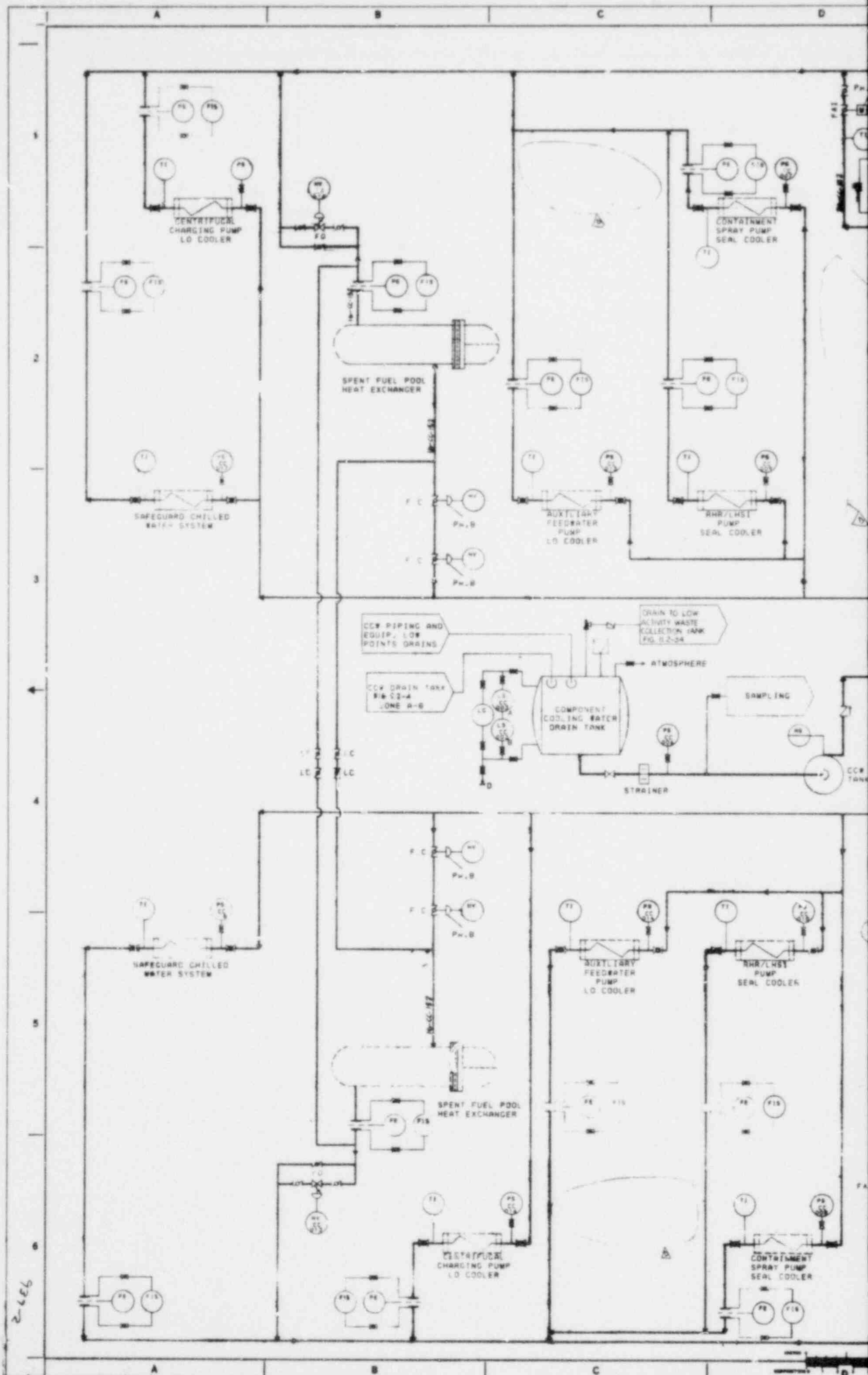
(DWG M-0104)

AMENDMENT 9

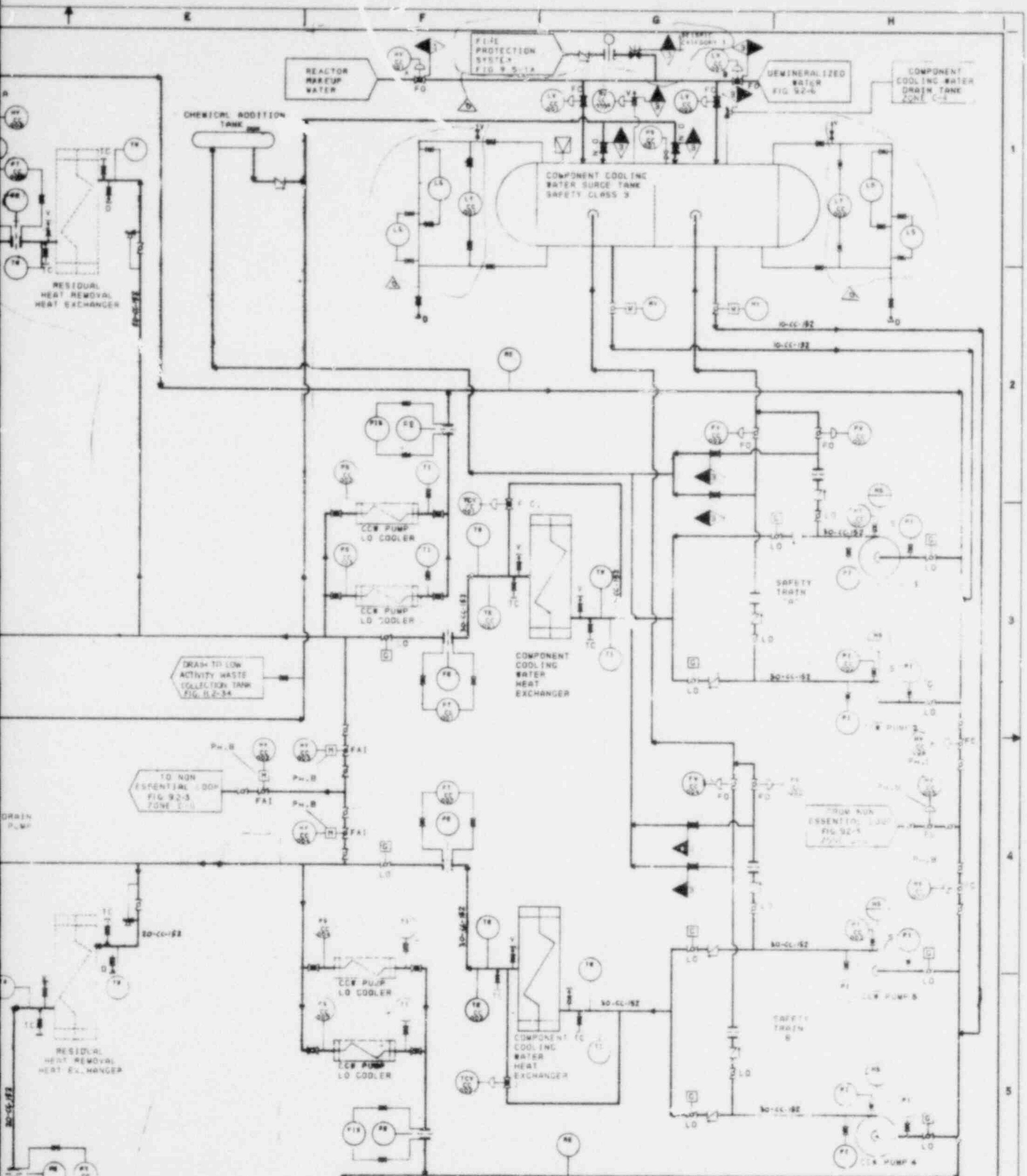
GIBBSSAR

NSSS:
NOT SPECIFIC ☐
W-414 ■
CE ☐
B&W ☐

FIGURE NO. 9.2-1



CENTRIFUGAL CHARGING PUMP LO COOLER
SPENT FUEL POOL HEAT EXCHANGER
CONTAINMENT SPRAY PUMP SEAL COOLER
SAFEGUARD CHILLED WATER SYSTEM
AUXILIARY FEEDWATER PUMP LO COOLER
RHR/LHSI PUMP SEAL COOLER
CCW PIPING AND EQUIP. LOW POINTS DRAINS
DRAIN TO LOW ACTIVITY WASTE COLLECTION TANK
ATMOSPHERE
CCW DRAIN TANK
COMPONENT COOLING WATER DRAIN TANK
SAMPLING
STRAINER

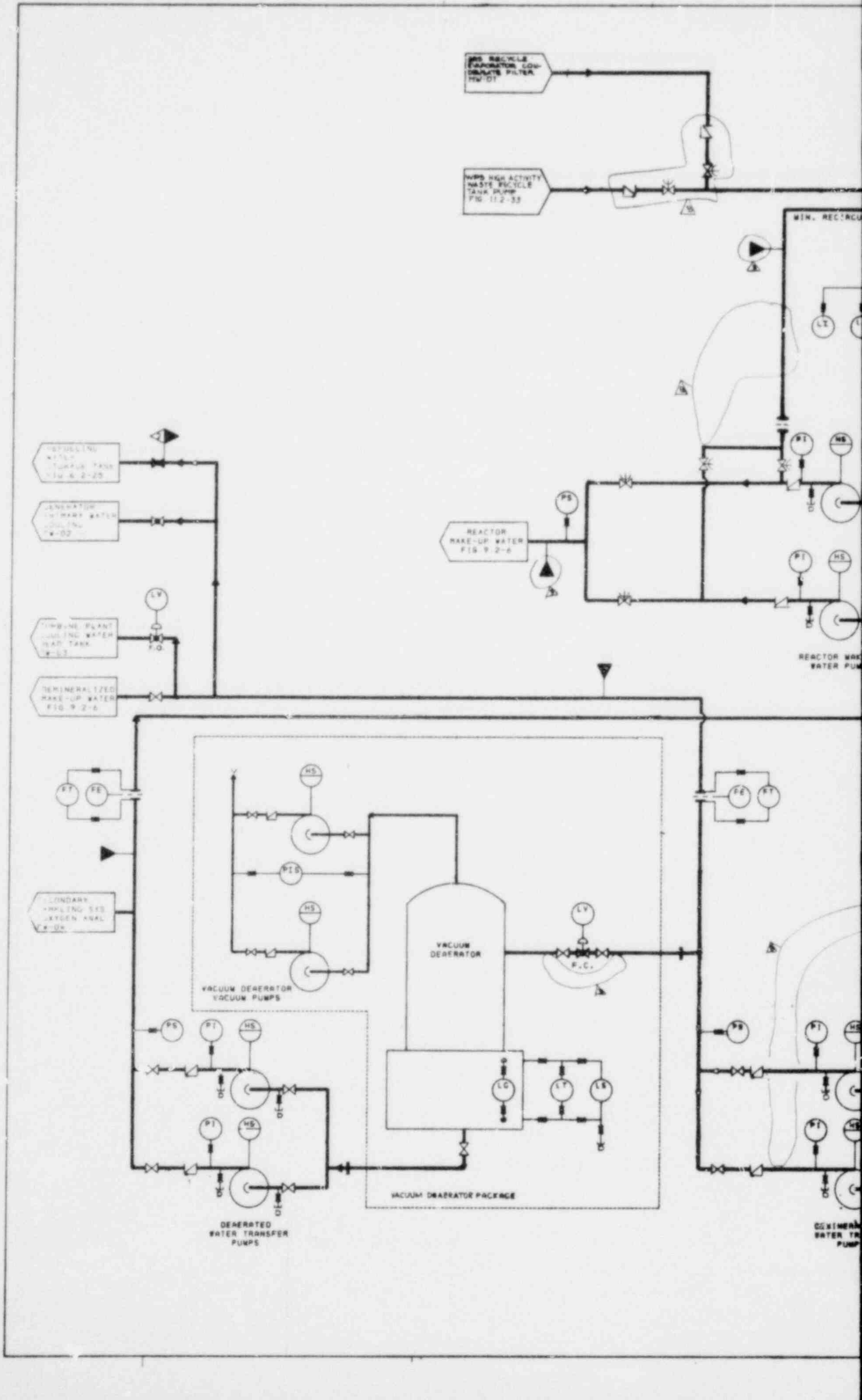


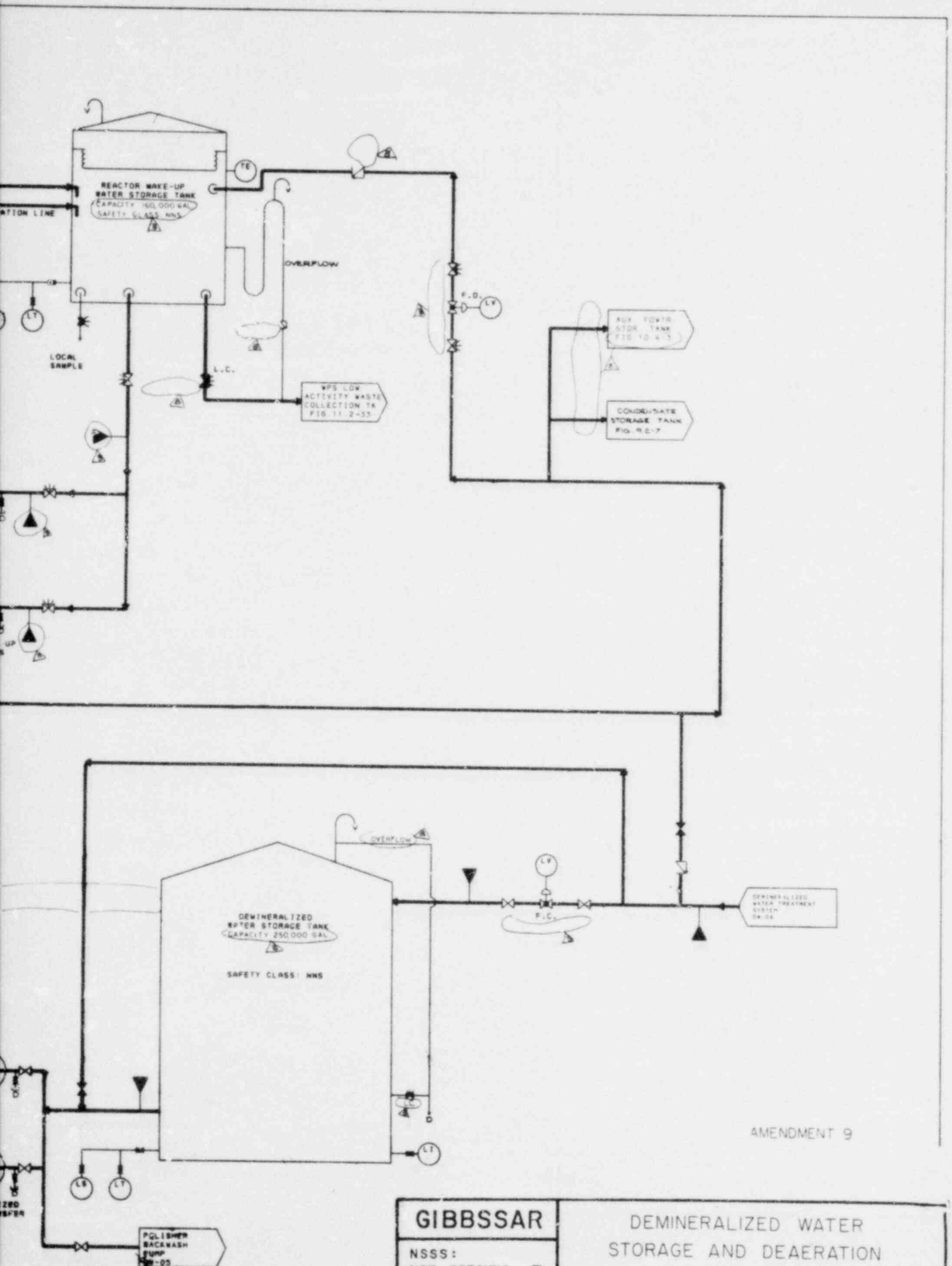
NOTES:

1. TOTAL SYSTEM IS SAFETY CLASS 3 EXCEPT AS NOTED.
2. FLOW DIAGRAM IS BASED ON USING A WESTINGHOUSE NSSS.

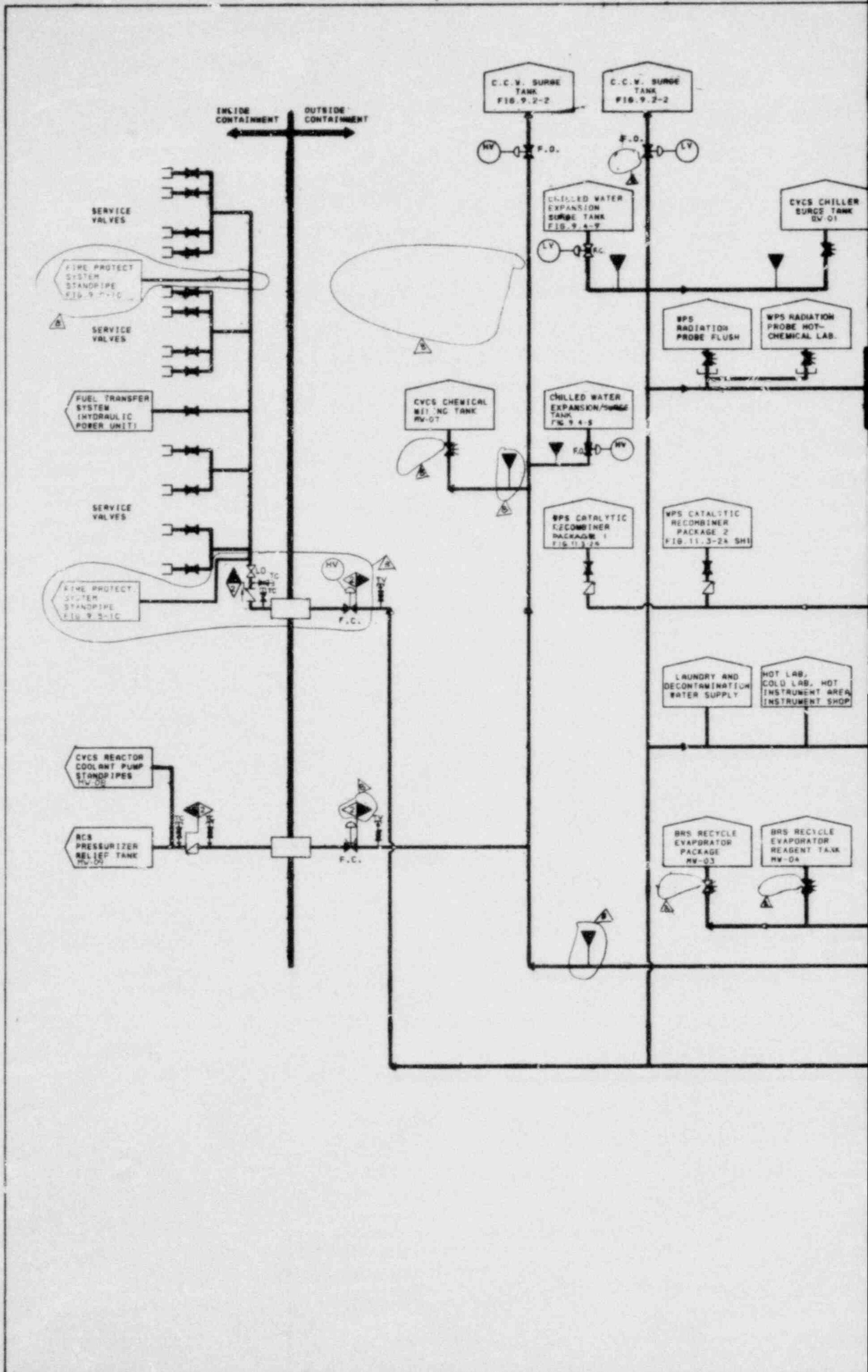
AMENDMENT 9
(DWG. M-0103 SH.1)

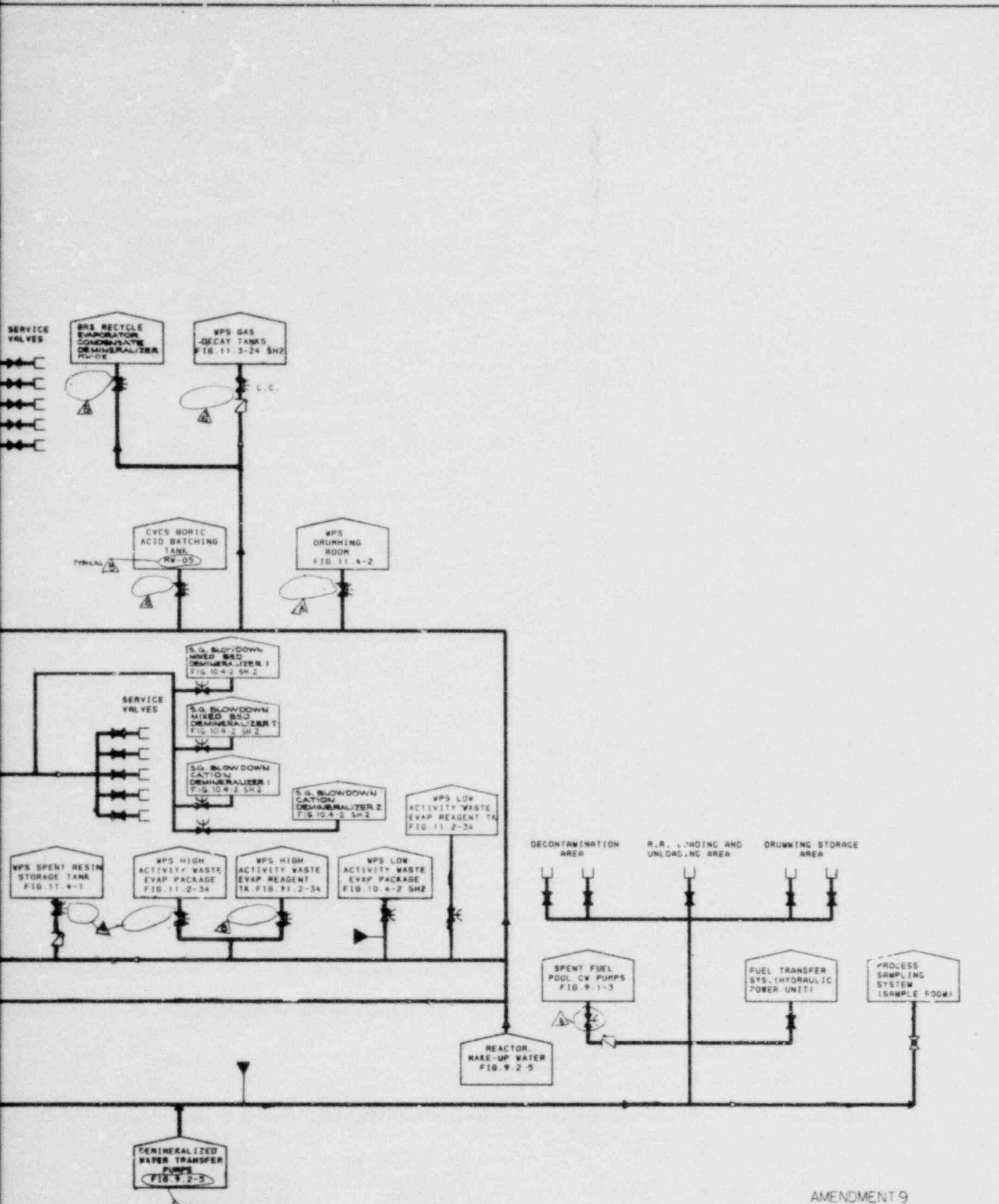
GIBBSSAR	FLOW DIAGRAM COMPONENT COOLING WATER SYSTEM
NSSS: NOT SPECIFIC ☐ W-414 ■ CE ☐ B&W ☐	FIGURE NO. 9.2-2


WPS HIGH ACTIVITY WASTE RECYCLE TANK PUMP FIG 11.2-33
MIN. RECIRCU
REACTOR MAKE-UP WATER FIG 9.2-6
PS
PI
HS
LI
REACTOR MAK
WATER PU
LV
F.O.
DEMINERALIZED MAKE-UP WATER FIG 9.2-6
FT
FE
PIS
VACUUM DEAERATOR
F.C.
VACUUM DEAERATOR VACUUM PUMPS
LG
LT
LS
VACUUM DEAERATOR PACKAGE
DEAERATED WATER TRANSFER PUMPS



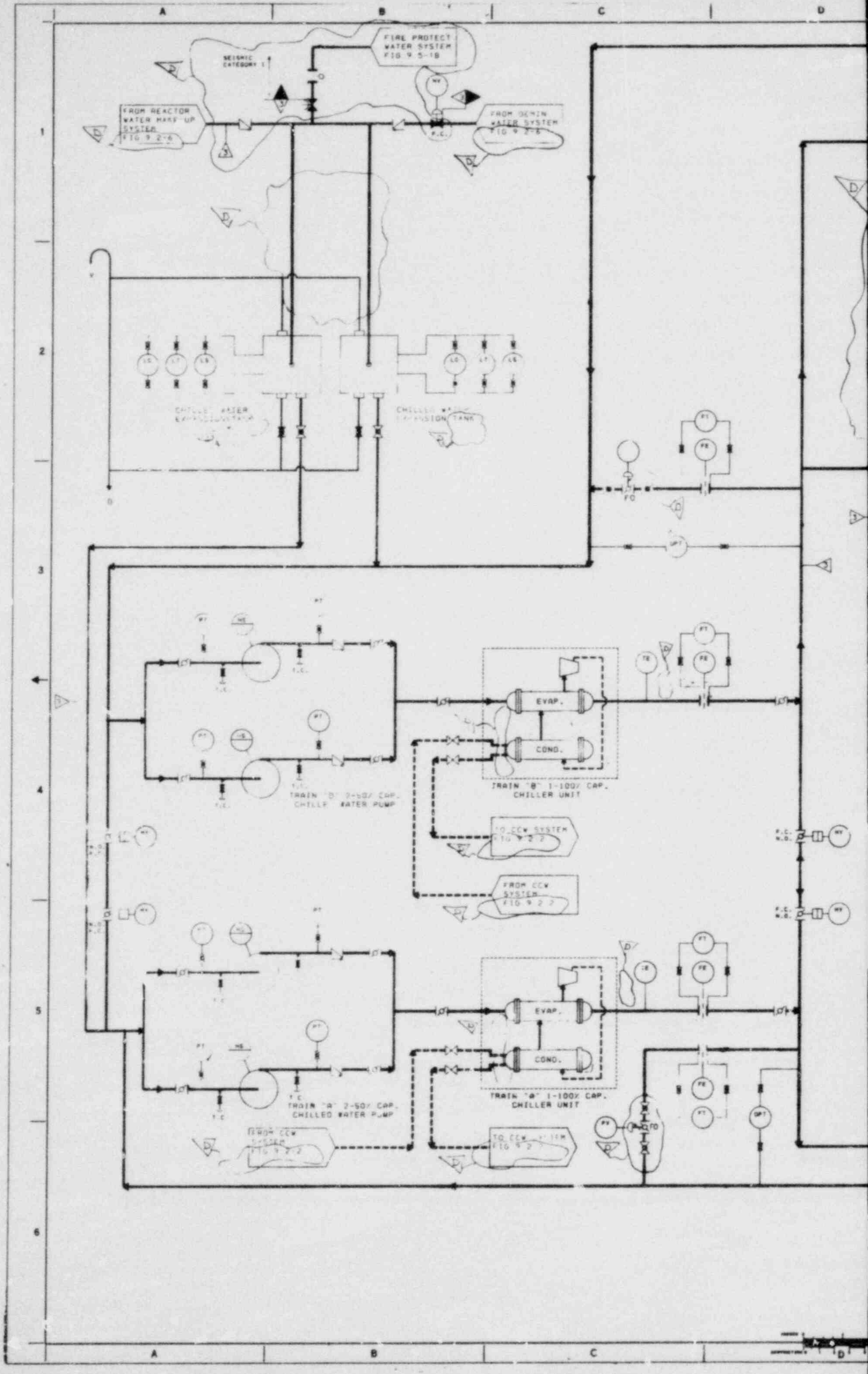
GIBBSSAR	DEMINERALIZED WATER STORAGE AND DEAERATION FLOW DIAGRAM
NSSS: NOT SPECIFIC ■ W-414 □ CE □ B&W □	FIGURE NO. 9.2-5

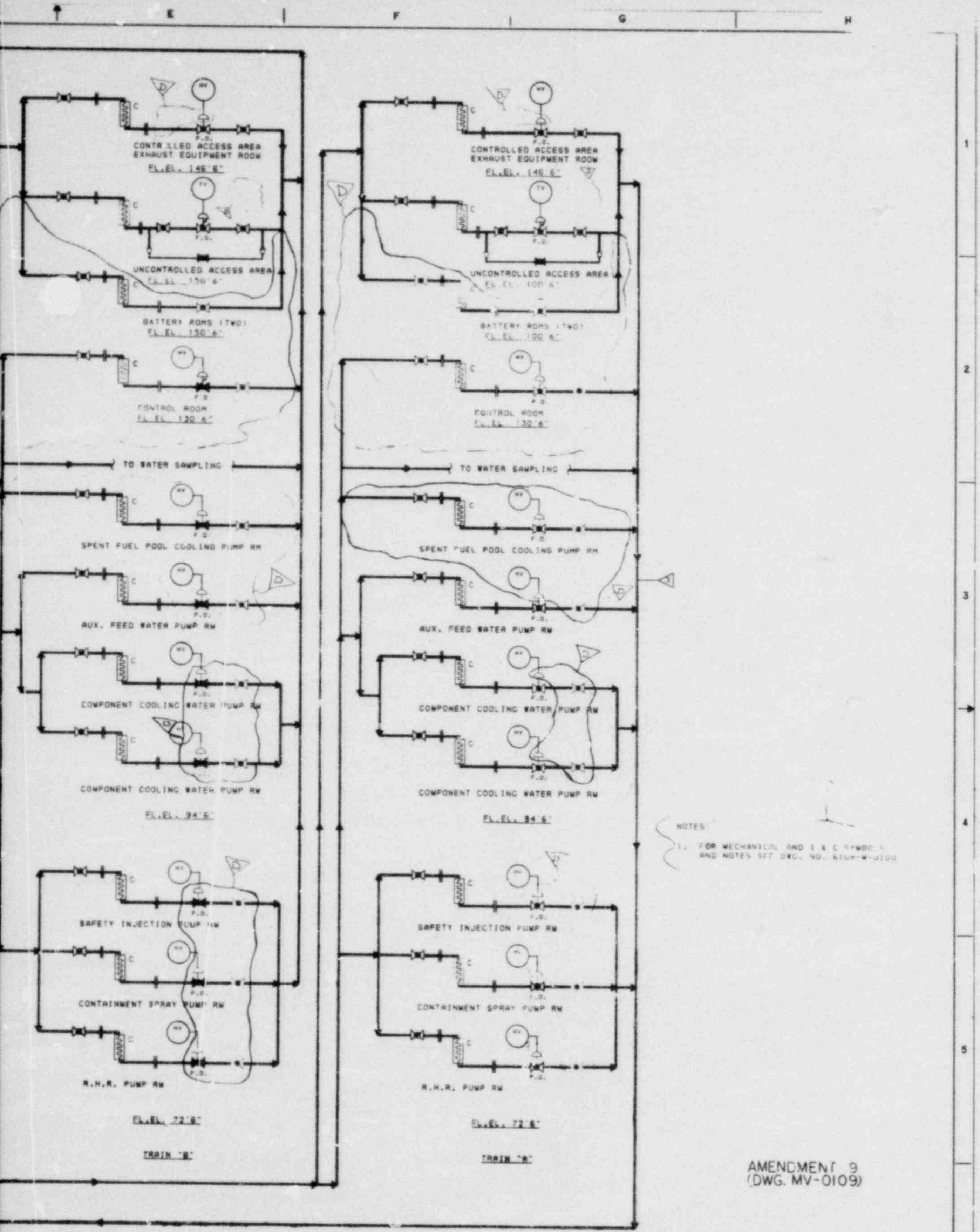

C.C.W. SURGE TANK FIG.9.2-2
C.C.W. SURGE TANK FIG.9.2-2
INSIDE CONTAINMENT
OUTSIDE CONTAINMENT
SERVICE VALVES
FIRE PROTECT SYSTEM STANDPIPE
SERVICE VALVES
FUEL TRANSFER SYSTEM (HYDRAULIC POWER UNIT)
SERVICE VALVES
FIRE PROTECT SYSTEM STANDPIPE FIG.9.5-1C
CVCS REACTOR COOLANT PUMP STANDPIPES MW-08
RCS PRESSURIZER RELIEF TANK MW-09
CHILLED WATER EXPANSION SURGE TANK FIG.9.4-9
CVCS CHILLER SURGE TANK BW-01
WPS RADIATION PROBE FLUSH
WPS RADIATION PROBE HOT-CHEMICAL LAB.
CVCS CHEMICAL MIXING TANK MW-07
CHILLED WATER EXPANSION/SURGE TANK FIG.9.4-5
WPS CATALYTIC RECOMBINER PACKAGE 1 FIG.11.3-24
WPS CATALYTIC RECOMBINER PACKAGE 2 FIG.11.3-24 SH1
LAUNDRY AND DECONTAMINATION WATER SUPPLY
HOT LAB, COLD LAB, HOT INSTRUMENT AREA INSTRUMENT SHOP
BRS RECYCLE EVAPORATOR PACKAGE MW-03
BRS RECYCLE EVAPORATOR REAGENT TANK MW-04
F.O.
F.C.
F.C.
LO
TC
HV
LV



AMENDMENT 9

GIBBSSAR	DEMINERALIZED WATER MAKE-UP SYSTEM FLOW DIAGRAM
NSSS: NOT SPECIFIC ☐ W-414 ■ CE ☐ B&W ☐	FIGURE NO. 9.2-6


A
B
C
D
1
2
3
4
5
6
FIRE PROTECT WATER SYSTEM FIG 9.5-1B
SEISMIC CATEGORY I
FROM REACTOR WATER MAKE-UP SYSTEM FIG 9.2-6
FROM DEMIN WATER SYSTEM FIG 9.2-6
CHILLED WATER EXPANSION TANK
CHILLED WATER EXPANSION TANK
EVAP.
COND.
TRAIN "B" 1-100% CAP. CHILLER UNIT
TRAIN "B" 2-50% CAP. CHILLED WATER PUMP
TO CCW SYSTEM FIG 9.2-2
FROM CCW SYSTEM FIG 9.2-2
EVAP.
COND.
TRAIN "A" 1-100% CAP. CHILLER UNIT
TRAIN "A" 2-50% CAP. CHILLED WATER PUMP
FROM CCW SYSTEM FIG 9.2-2
TO CCW SYSTEM FIG 9.2-2
A
B
C
D

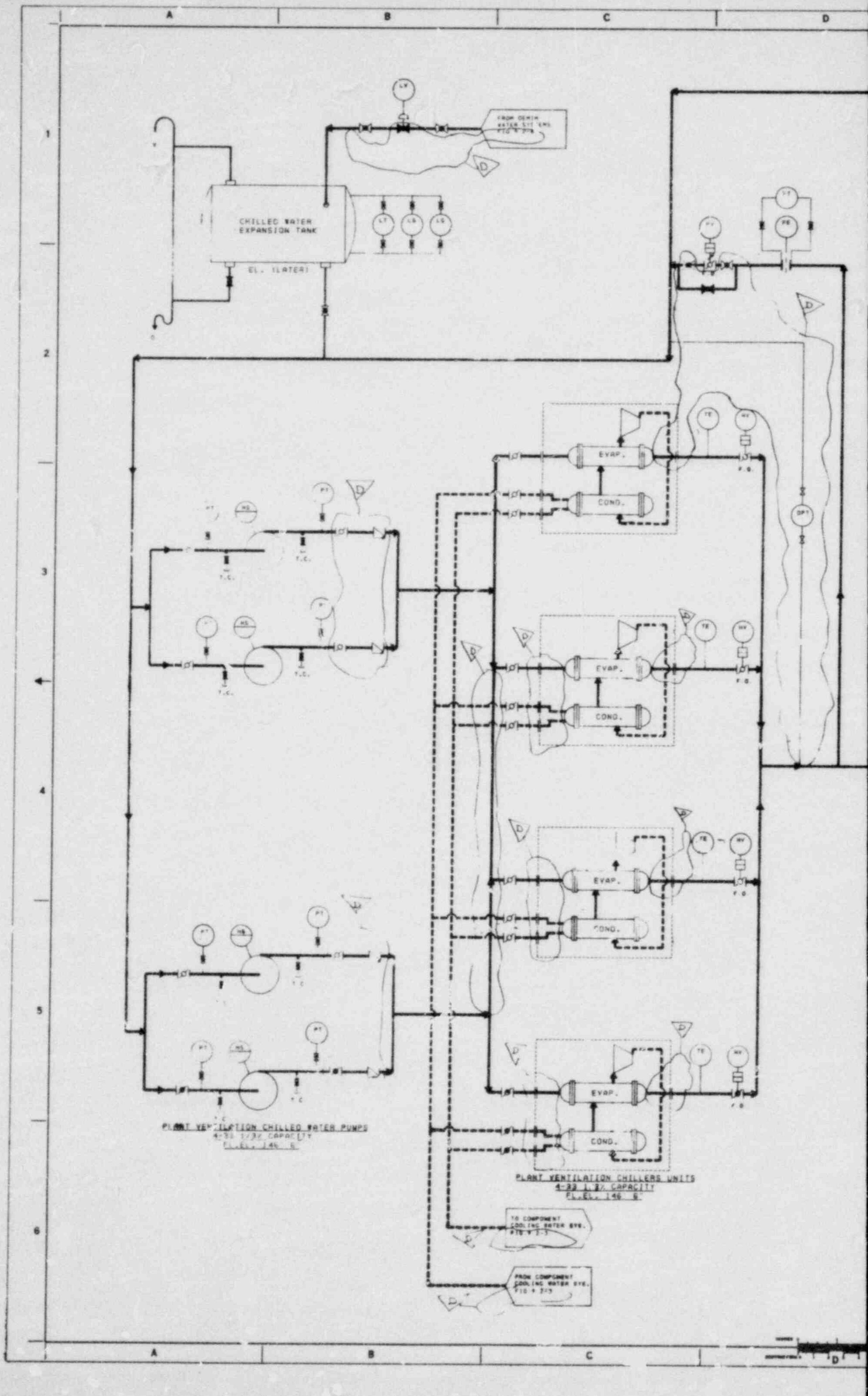


GIBBSSAR

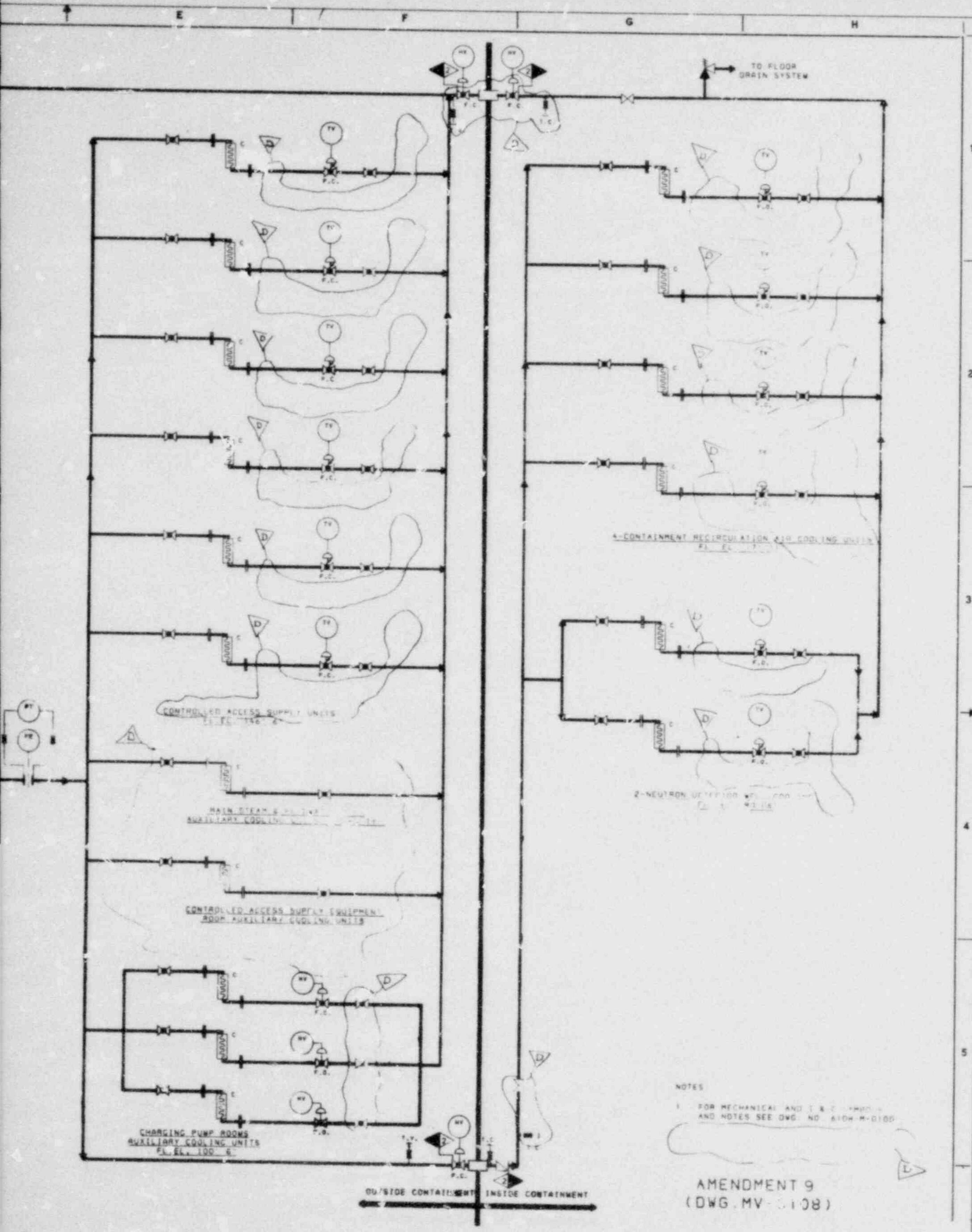
NSSS:
NOT SPECIFIC ■
W-414 □
□
B&W □

VENTILATION SAFETY FEATURE
CHILLED WATER SYSTEM
FLOW DIAGRAM

FIGURE NO. 9.4-5

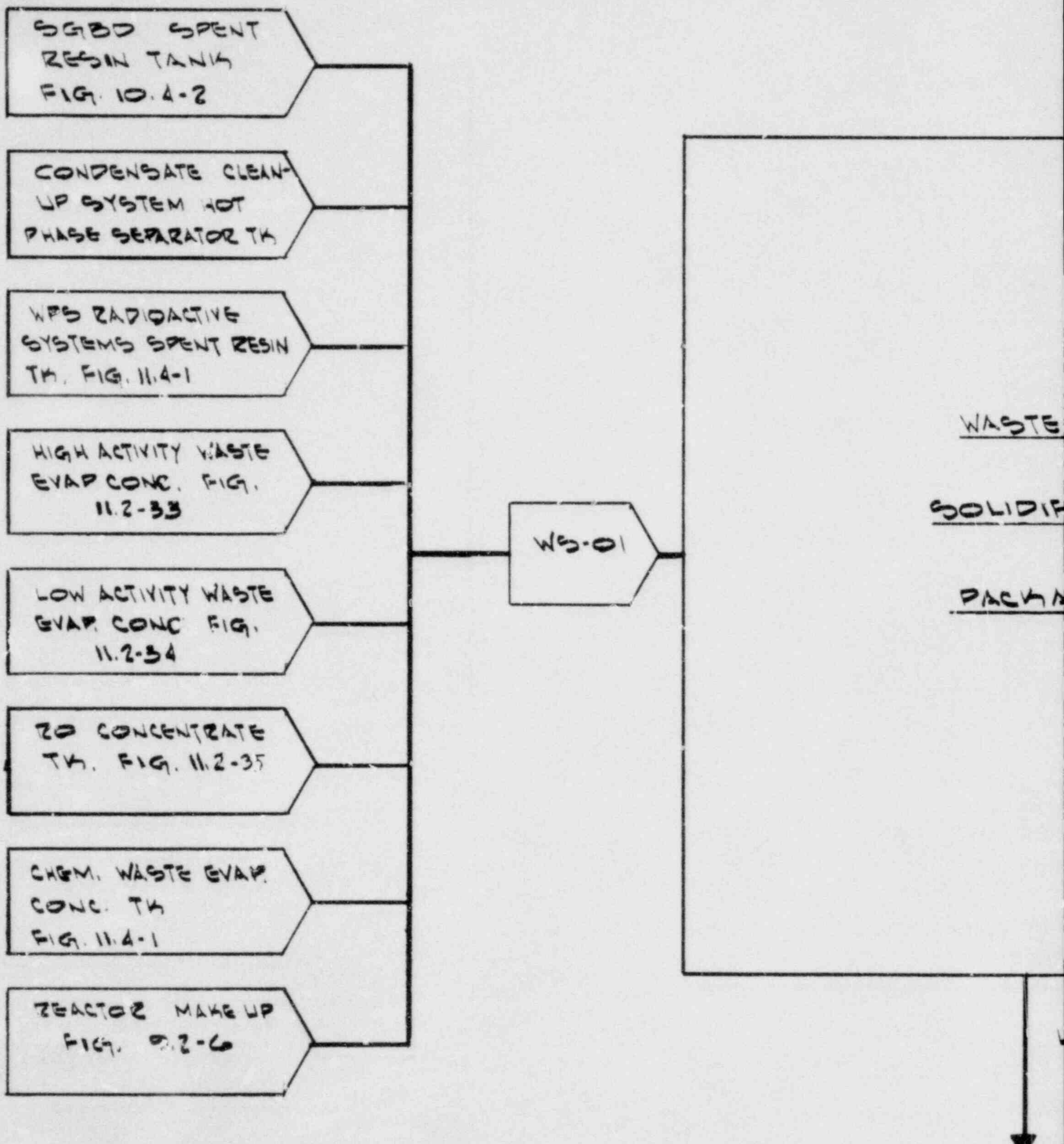


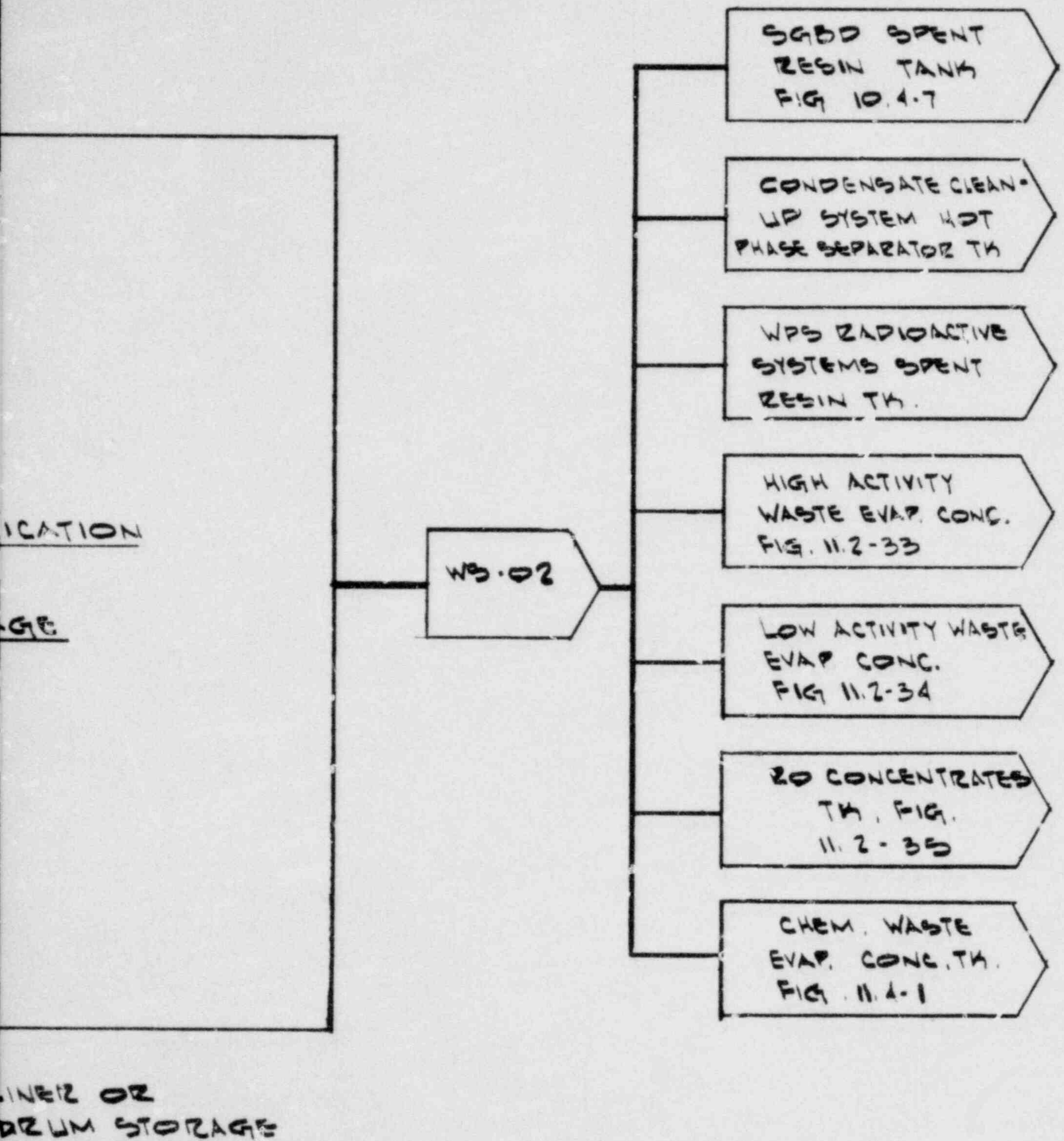
CHILLED WATER EXPANSION TANK
EL. (LATER)
FROM DEMIN WATER SYSTEMS
EVAP.
COND.
PLANT VENTILATION CHILLED WATER PUMPS
FL.EL. 146' 6"
PLANT VENTILATION CHILLERS UNITS
FL.EL. 146' 6"
TO COMPONENT COOLING WATER SYS.
FROM COMPONENT COOLING WATER SYS.



AMENDMENT 9
(DWG. MV-□108)

GIBBSSAR	PLANT VENTILATION CHILLED WATER SYSTEM FLOW DIAGRAM
NSSS: NOT SPECIFIC ■ W-414 □ CE □ B&W □	FIGURE NO. 9.4-9


SGBD SPENT RESIN TANK FIG. 10.4-2
CONDENSATE CLEAN-UP SYSTEM HOT PHASE SEPARATOR TK
WPS RADIOACTIVE SYSTEMS SPENT RESIN TK. FIG. 11.4-1
HIGH ACTIVITY WASTE EVAP CONC. FIG. 11.2-33
LOW ACTIVITY WASTE EVAP. CONC FIG. 11.2-34
RO CONCENTRATE TK. FIG. 11.2-35
CHEM. WASTE EVAP. CONC. TK FIG. 11.4-1
REACTOR MAKE UP FIG. 9.2-6
WS-01



GIBBSSAR	SOLID WASTE PROCESSING SYSTEM
NSSS: NOT SPECIFIC ☐ W-414 ■ CE ☐ B&W ☐	FIGURE NO. 11.4-2